SCIENTIFIC AMERICAN

The Efficiency of the United States Army
What Is Old Age?
The Machinery of a Modern Great Hotel

Vol. CIX. No. 22
November 29, 1913

Munn & Co., Inc., Publishers
New York, N. Y.

Price 10 Cents
$3.00 A Year

Only One Thing Ever Starts a Gasoline Motor — ***Hot Vapor***—Gasoline in Liquid Form Never Started Anything!

For Use on Any Auto whether equipped with Self-Starter or Not

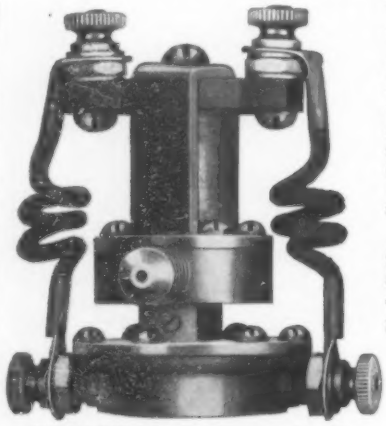
SURE-START Electric Vaporizer

Easily and Quickly Attached to Any Auto

This new invention fills Your Manifold With HOT VAPOR — delivers HOT VAPOR direct to Firing Chamber

Sold on Guarantee to Satisfy. Return after 30 Days If You Can Do Without It—Money Back. Price $8.00 complete. Ready to Attach. When ordering mention make of car, size of gasoline feed line and whether gravity or force feed.

Turn small switch on the dash; then crank your motor in the usual way and an *immediate* start is *assured* regardless of weather conditions or poor gasoline



SURE-START Electric Vaporizer — Exact Size. Weight 10 ounces

What Sure-Start Electric Vaporizer Does

Gasoline from main feed line is admitted to vaporizer by an electrical valve. Gasoline runs through an electrically heated compartment and is then admitted into the intake manifold in the form of a hot vapor. Sure-Start fills the manifold with Hot Gasoline Vapor—that assures a start.

A Wonderful Invention

The Sure-Start Electric Vaporizer has been pronounced the most important new idea or invention in motor equipment for ten years. It eliminates all starting troubles—all liquid priming—long-time cranking—and all starting troubles caused by cold weather or low-grade gasoline.

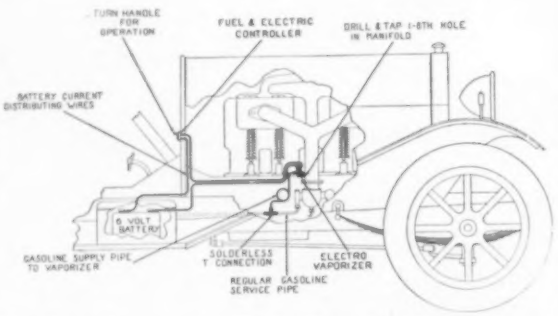
Note These Points:

Sure-Start Electric Vaporizer needs no attention after being once attached to your car. Can be used or not, at your discretion. Does not interfere with the regular workings of the car.

Sure-Start gives the vital impulse—creates real engine-energy, to start your motor. The **Sure-Start** Electric Vaporizer is a NEW, proven-practical **fuel vaporizer** which effectively overcomes the deficiency of all carburetors—it **insures instantaneous vaporizing of fuels.**

The common practice of priming with ether or gasoline through spark plugs or pet cocks is eliminated. A simple turn of the switch is all that is necessary. **Sure-Start** Vaporizer does the rest.

Sketch illustrating application of SURE-START Electric Vaporizer. This is not drawn to scale—the Vaporizer being exaggerated in size.


TURN HANDLE FOR OPERATION
FUEL & ELECTRIC CONTROLLER
DRILL & TAP 1-8TH HOLE IN MANIFOLD
BATTERY CURRENT DISTRIBUTING WIRES
6 VOLT BATTERY
GASOLINE SUPPLY PIPE TO VAPORIZER
SOLDERLESS T CONNECTION
ELECTRO VAPORIZER
REGULAR GASOLINE SERVICE PIPE

Sure-Start Used in Connection With Electric Self-Starters

Sure-Start saves your batteries because it eliminates the prolonged strain. Order it now and end your starting troubles. Your Self-Starter—no matter what style it is—is really a self-cranker. It relieves you merely of the engine-turning burden. So far—all right! But Starting Troubles still bother you, particularly in cold weather. That's because your gasoline is not vaporizing. **Sure-Start,** used in connection with a Self-Starter, makes a start **absolutely certain. Sure-Start** really saves your batteries when so used and is a big economy. Its consumption of current is insignificant.

Sure-Start is economical in its operation. A very small amount of electric current from any ordinary 6 volt battery supplies vaporizer.

The **Sure-Start** Electric Vaporizer in conjunction with electric, air or mechanical starters makes the operation ideal and gives results that make it indispensable.

Get a dependable start with a **Sure-Start** and avoid broken arms. **Money Back** after 30 days if you wish it. Order Direct. Address

W. E. & J. H. DODSON, Sales Agents

UNITED MOTOR EQUIPMENT COMPANY

DEPT. E, SUITE 1204, ASSOCIATION BUILDING, CHICAGO, ILL.

Sixteenth Annual Motor Number

of the

Scientific American

January 3, 1914

THE oldest automobile paper in the world is the Scientific American. It has followed the development of the motor-driven vehicle from the very day of its birth, aiding and encouraging the "horseless carriage" in its early struggle for existence. Every important phase of its progress has been chronicled in these columns. For the past sixteen years we have published an annual resume of its growth in a special magazine number. Our first automobile number antedates the New York Annual Automobile Show by two years.

Everything new that is important will be taken up in our coming Motor Number. Among the subjects are the following:

The Automobile of 1914. There are fashions in automobiles as well as in dress. Although the American automobile is pretty well standardized, nevertheless there will be important differences in the car of 1914, which every motorist should know. Just what the changes are will be fully explained and illustrated.

New Ideas in Car Bodies. While we in this country have fixed upon a standard form of car body, abroad, particularly in France, new designs are being developed which are most interesting. Some of the new car bodies look exactly like a boat. Fifteen car body designs will be illustrated and described.

The newest and most ingenious accessories will take up a page of the Motor Number. Of the making of accessories for automobiles there seems to be no end, yet, no doubt, many of them will prove indispensable to the motorist of 1914.

Lubrication is a subject that is far more important than the majority of automobilists realize. An excellent article on this subject is being prepared by an authority on oils.

Lessening fuel cost is perhaps the foremost topic of the year. Experiments are being made with new fuels and with apparatus that will permit the use of substitutes for gasoline. Our Paris correspondent will tell what is being done in this connection abroad.

Making the automobile comfortable in winter. Although the automobile was made an all-the-year-round machine long ago, it must be admitted that motoring is not half so pleasant in winter as in the warmer seasons. However, many improvements have been developed recently to overcome the rigors of frigid weather.

What car can I buy for $500, $1000, $1500, etc.? A feature of the Motor Number of 1913 was a table which classified American-made cars according to price. A similar table, but even more complete, is being prepared for 1914.

The commercial motor vehicle will receive due attention in the Motor Number. Important problems that present themselves to the owner of a commercial vehicle and to the intending purchaser of a motor truck will be treated by authorities on the subject.

Motor truck guide. Like the table on pleasure vehicles there will be a classified list of commercial vehicles arranged according to capacity which should prove indispensable as a guide to intending purchasers of motor trucks.

A Colored Cover by William Harnden Foster

Price, Fifteen Cents **On All Newsstands**

SIXTY-NINTH YEAR

SCIENTIFIC AMERICAN

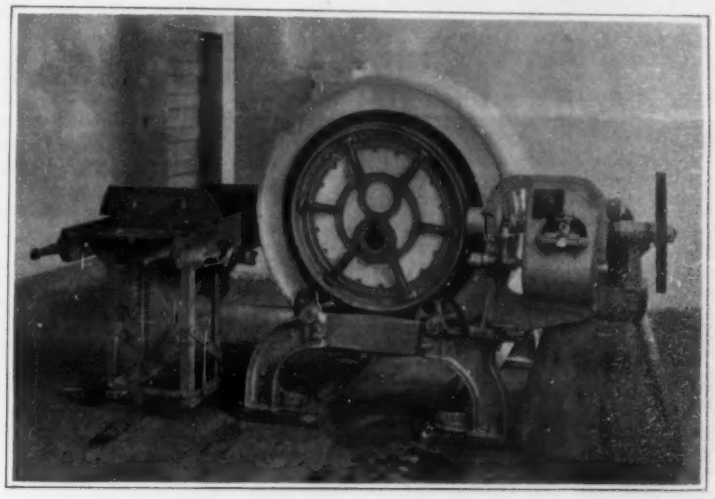
THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CIX
NUMBER 22.

NEW YORK, NOVEMBER 29, 1913

PRICE 10 CENTS
$3.00 A YEAR

Filling the silo by electric power.



Electrically operated butter churn and butter worker.

Central Station Power for Farmers

Relieving the Tedium of Farm Work by the Use of Electricity

By D. R. Palmquist

REALIZING that the farm offers a large outlet for electric power, many central stations throughout the country have extended their transmission lines into the rural districts. From these lines they are supplying the farmers with electricity for light and power. This is particularly true of the States throughout the corn belt. The general farming in vogue there requires a large amount of mechanical power, for grinding feed, shredding fodder, cutting ensilage, threshing, and pumping water. The farmers throughout this region, the majority of whom are conducting their farms on a scientific basis, take to this new form of power as a duck would to water.

The manufacturers have done a great deal in making it possible to use electric power on farms, as they are now offering all sorts of farm machines readily adaptable for electric drive. There is scarcely a modern electric device for the farm that is not effecting a large saving in time and a consequent reduction in the amount of hired help needed, for most of the ordinary appliances require but one operator.

In order to make this article more practical and instructive, I will include some specific data and information, as to the cost of using electric power on farms.

Cost of Farm Installations.

At Eureka, Illinois, there are about twenty miles of transmission lines, traversing a good farming district. At the present time, there are about sixty farmers on these lines. Most of them live near the transmission line. Some, however, are not so near. This necessitates the building of branch lines, which is done by the company, at the expense of the farmer.

The company's plan is to place transformers in the most convenient place for distribution to three or more farmers, if possible, and to require them to bear the expense of building the secondary lines from the transformers to their buildings. The farmer also pays for the wiring of his house and barns.

Motors are used for all purposes, such as pumping water, grinding feed, sawing wood, elevating grain into cribs and granaries, on cream separators, churns, washing machines, sewing machines, fans, and most of them use electric irons.

Many have large tungsten lamps on poles in door, barn and feed yards, and without exception they appreciate these lights very highly.

The following data show what it is actually costing the average farmer in this community to equip his house and barns for electricity, and also the uses he finds for it.

Farm No. 1.—Cost of wiring house and barn, $86; cost of meters, $51.50; number of lights installed, 30; number of motors installed, 2; size of motors, 5 horsepower and ½ horse-power. Farm machines operated by above motors: Feed grinder, grain elevator, cream separator, churn, wash machine.

Electrically operated fodder cutter.

Farm No. 2.—Cost of wiring house and barn, $112; cost of meters, $51.50; number of lights installed, 40; number of motors installed, 2; size of motors, 3 horsepower and ½ horse-power. Farm machines operated by motors: Grain elevator, feed grinder, cream separator, churn, pump, wash machine, grind stone.

Farm No. 3.—Cost of wiring house and barns, $86; cost of meters, $51.50; number of lights installed, 30; number of motors installed, 2; size of motors, 3 horsepower and ½ horse-power. Machines operated by above motors: Feed grinder, grain elevator, pump, cream separator, wood saw, wash machine.

The above are typical of the average farm installations at Eureka, Illinois. As these farmers become more accustomed to the uses of electricity and realize its advantage, they will apply the electric drive to their many other farm machines.

Last January fourteen farmers petitioned the power company at Eureka to extend their lines so that electricity would be available for their use. At that time the power plant was taxed to the limit, which did not enable them to take on any more customers. They are now enlarging their plant and intend to take on these farmers.

Operating Cost of Farm Machines.

Bearing in mind that electricity is available for both light and power, let us see what it is costing these farmers to use electricity. Based on an average of 10 cents per kilowatt hour—equivalent to 7½ cents per horse-power hour—the cost of lighting amounts to a fifth of a cent an hour for a sixteen candle-power tungsten lamp. For power purposes the rate averages about 5 cents per kilowatt hour.

They say that when a horse begins to eat its head off, there are two ways out of the difficulty: Either work the beast hard enough to earn its keep, or look around for a means of power with a more reasonable appetite. A one horse-power motor costs approximately $65, with an operating cost averaging 5 cents an hour. A good horse costs from $150 to $250, with an operating cost averaging 8 cents an hour. A one eighth horse-power motor equivalent to one man power costs $40, with an operating cost of less than one cent an hour. The Department of Agriculture states that the farm horse averages about 3½ hours of work a day the year round, and he eats fodder steadily. The electric motor, on the other hand, consumes energy only when it is in operation.

Now let us consider some of the farm machines to which electric motor drive has been successfully applied and from which the cost of operation has been deduced by authoritative tests. These tests were made under actual working conditions on farms; and though the figures are susceptible of slight variation, due to individual controlling circumstances, they afford a fair standard in considering the advisability of using electric power on the farm. All operating costs are based

(Concluded on page 417.)

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, NOVEMBER 29, 1913

Published by Munn & Co. Incorporated. Charles Allen Munn, President
Frederick Converse Beach, Secretary and Treasurer
all at 361 Broadway, New York

Entered at the Post Office of New York, N. Y., as Second Class Matter
Trade Mark Registered in the United States Patent Office

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Subscription Rates

Subscription one year $3.00
Postage prepaid in United States and possessions, Mexico, Cuba, and Panama

Subscriptions for Foreign Countries, one year, postage prepaid, 4.50
Subscriptions for Canada, one year, postage prepaid, ... 3.75

The Scientific American Publications

Scientific American (established 1845) . . . . . per year, $3.00
Scientific American Supplement (established 1876) . " " 5.00
American Homes and Gardens . . . . . " " 3.00
The combined subscription rates and rates to foreign countries including Canada, will be furnished upon application.

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Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Rest and Railway Safety

SEVERAL years ago, when the New York Central Railroad inaugurated the twenty-hour service to Chicago, the Editor of this journal was given an opportunity to ride in the cab of the several engines which pulled the train over the various divisions. On the round trip he rode on some eight or nine engines and talked with as many different enginemen. Subsequently, he met by appointment the engineman who covered the run from New York to Albany and back, a veteran in the service. He was tall, well set up, clear eyed, of ruddy complexion, and in his off-duty clothes he might readily have been taken for a prosperous, well-preserved business man of sixty years. We mention these facts because at the outset of our talk about his experiences, he told us that for thirty years he had been at the throttle of the fastest expresses that were run out of New York city on the New York Central system. There is a popular impression that the man who pulls an express train is subjected to such severe mental strain, that, after a very few years, he has to be transferred to less strenuous work on slower local trains, to give him an opportunity to recuperate; yet here was a man who had been doing this work for the greater part of his working lifetime and had come through it in perfect physical condition.

So we spoke of this popular belief and asked what was the secret of his successfully carrying such heavy responsibility without any impairment of his physical or mental equipment. "It may be," he said, "that I am temperamentally suited to this work; but my own belief is that my present physical condition is due to the fact that I have taken the very best care of my health by abstaining from stimulants, keeping regular hours, and above all, being careful to get sufficient sleep between runs."

Now this little talk of many years ago is brought forcibly to our recollection by a document, sent out by the Pennsylvania Railroad Company, which states that it is considering the advisability of establishing a rule, that employees must live or take their rest sufficiently near to their work to enable them to report for duty at any hour, day or night, with not more than one hour of necessary traveling between their homes or resting places and the point where they begin work. The statement goes on to say that many cases have come to the notice of the management, wherein men are living considerable distances from their place of work, and that though they spend only a reasonable time on duty, so much additional time is required in traveling to and from work that they do not have sufficient rest and recreation. In some instances men live from 50 to 100 miles from the place where they report for duty.

If this company should take well-considered action in the matter, it will establish a precedent which should be followed by every railroad throughout the country, and we believe that the present is a very opportune time to set such a movement afoot. The terrible disaster at North Haven on the New Haven Railroad is fresh in the public mind. In their investigation of the accident, the Interstate Commerce Commission found that in each twenty-four hour period, Engineman Miller, of the colliding train, mainly because he lived a considerable distance from the point where his run began, had had less than six hours of rest in bed at his home. The Commission stated in its report that no engineman who took his rest in such a manner as Engineman Miller did while performing double duty, could be in proper physical or mental condition to perform the exacting service required of an engineman on a high-speed passenger train.

We are in hearty accord with this opinion. It would be possible to establish a rule which would equitably cover every interest involved, so that the men may have every reasonable freedom in directing their private lives to suit themselves, but always under the stipulation that they shall live or take their rest at points which will enable them to report for work without undue time being consumed in their doing so. Consideration of the interest of the traveling public, the railroad companies, and of the trainmen themselves demands that specific rules should be laid down covering this most important question.

Not Sea Water, but Sewage

AMONG the long-neglected municipal problems which will confront the lately elected administration of this city is that of sewage disposal—than which, surely, no more vital question affecting the physical well-being of the five million inhabitants of New York can be found to-day.

There is a popular and altogether erroneous belief that because there are tidal movements in New York Harbor, and because there are heavy currents in the North and the East Rivers, the sewage of the city is no sooner disgorged into these waters, than it is swept away, carried out to the Atlantic, and harmlessly dissipated in the sea.

As a matter of fact, nothing of the kind happens. The huge floods of sewage (they are nothing less) are discharged into the rivers and the bay and there their solid contents are deposited and there they remain. Every twenty-four hours there is poured into the Harlem River ninty-nine million gallons, into the North River one hundred and thirty-two million gallons, and into the East River two hundred and sixty-four million gallons of sewage. And this, be it remembered, has been going on in its relative proportions for centuries. The filthy deposit resulting from this back-yard method of disposal has steadily accumulated, until the waters that surround this, the second greatest city of the world, are underlaid by an unmentionable deposit, the mere thought of which should bring a blush to the cheek of every citizen in this age of advanced ideas as to cleanliness and decent sanitary habits.

That there is movement in the waters of the bay and the river is true; but it is a movement merely back and forth. There is no endless sweep of the whole mass of water out to the sea, and the substitution of unpolluted water in its place. The Metropolitan Sewerage Commission of New York proved this to a demonstration by placing floats in various localities and recording their movements. One of these floats put in the East River, traveled in 78½ hours a distance of 107¾ miles, at the end of which time it was picked up only one mile from the starting point. After learning this, need it cause any surprise to learn further, that every year the Department of Docks and Ferries dredges out some 400,000 cubic yards of deposit from the slips and docks of the lower East River, to say nothing of large quantities that are also dredged out by private enterprise?

Now the Sewerage Commission, which is composed of engineers of international reputation, has drawn up a plan of sewage disposal, which, if followed, will serve to clean up the maritime backyards and alleys of this city, and substitute in New York conditions that are wholesome and decent. In this plan the Harlem River is taken care of by trunk sewers which will lead to a large settling basin at Ward's Island, where the solids will be taken out and either burned or carried to sea in barges, and there dumped. The North Shore of Long Island, within the city limits, is to be provided with a similar trunk system, with a settling basin for a like method of treatment at Tallman's Island, on the Sound. The greater part of Manhattan is to be served under the proposed scheme by smaller local settling basins, located at the foot of various cross streets, where the solids will be incinerated. Similar local basins are to take care of the sewage of the East River from Newtown Creek to the upper end of Blackwell's Island. The worst and most polluted section of the East River from Newtown Creek to the Battery will be relieved by the construction of large, main sewers along the opposite shores, the contents of which will be led in a tunnel reaching below Brooklyn to Coney Island, and thence to a large settling basin, built three miles out at sea. From this the sludge will be taken in tank steamers and dumped 90 to 100 miles out at sea.

The plan of disposal, as thus worked out, is based upon methods, the efficiency of which has been amply demonstrated in existing plants everywhere. It presents a ready and not too costly means of escape from the present intolerable conditions; and it is to be hoped that the incoming administration will make this one of the earliest measures for civic improvement to receive their indorsement.

Engineering Competitions in Our Navy

THE European cruise of certain battleships of the Atlantic Fleet will furnish an excellent opportunity for close competition in engineering under service conditions; and the performance of the vessels cruising the Atlantic together in the voyages to and from the Mediterranean will be watched with the closest attention. In the days of the sailing ship the amount of fresh water available on board was the item which generally gave the greatest concern; but the all-important factors for the seaman are now the amount of fuel on hand, the amount that must be expended in steaming so many miles per hour, and that necessary for the maintenance of the officers and men. Because of the extent of our coast line, and of the distances which our vessels may be expected to cover in the event of hostilities, mobility for ships of all classes composing our fleets is the first requisite. Ours must be a "Steaming Navy."

In Rio de Janeiro in January, 1908, the commander-in-chief of the United States Atlantic Fleet, which was then on its celebrated cruise around the world, issued an order inaugurating the competition in engineering for the battleships and destroyers composing the fleet at that time making the voyage to the Pacific. The competition included the development of maximum speed under forced and natural draft, and economy of coal and oil under these, and under ordinary cruising conditions. Breakdowns were penalized and water, when received from an outside source, was charged against the ship receiving it. This competition ended upon the arrival of the fleet at Magdalena Bay, Lower California. The distance steamed was 8,210.5 knots, and it was estimated that a total net increase in economy of 1,460 tons of coal was realized, directly due to improvements in methods.

Taking the performances on the voyage from Rio to Magdalena Bay as a standard, it was estimated that 2,425 tons of coal was saved on the run from San Francisco to Manila Bay. On the same basis it was also ascertained that over 8,000 gallons of lubricating oil was saved. Two vessels more than doubled their cruising radius as far as oil was concerned.

Despite the unfavorable weather encountered on the voyage across the Atlantic when homeward bound, and the long time which had elapsed since the last docking of ships, the saving in fuel compared with the trip from Hampton Roads to Rio on the outward voyage amounted to over 5.5 per cent. The results obtained on this cruise sufficiently demonstrated the advantages of competitive methods, and in June, 1909, a general order from the Navy Department established the engineering competitions as a permanent feature in the operation of vessels.

Winning vessels of the different classes each year are awarded the trophies, consisting of bronze plaques, which are carried by them for the succeeding twelve months as symbols of their efficiency. Each petty officer and man of the engineering department of a ship winning the trophy is allowed to wear a red letter "E" on the sleeve of his uniform, and these emblems are greatly esteemed by the individuals who have striven hard for twelve months in an unremitting effort to produce economy and efficiency in their department. The commanding and certain engineering officers of a winning vessel receive commendatory letters from the Navy Department.

But few of the visitors to warships have any idea of the details to be mastered, and the work accomplished in maintaining the power plant installed on a modern dreadnought. They have no conception of the devotion to duty which is necessary on the part of each individual working in his own, sometimes obscure, uncomfortable, and frequently dangerous, corner, with the full knowledge that he must do his part to the end, out of the sight of men, and without the recognition which those who work in daylight above him may receive. The toll of death due to casualties in engine and fire rooms far exceeds that in turrets and magazines; yet there has been no shrinking, and no holding back. There is no class of men on board a ship with a higher sense of duty, better discipline or traditions, or who are more apt to acquit themselves with credit in time of stress than the members of the engineer's division. Their duties are of equal, if not greater, importance than those of their shipmates who fight the guns. It is as necessary for a ship when called upon for battle to reach and to maintain a station favorable for the fighting as it is to show accuracy and skill in gunnery after this station has been reached. The men below cannot hope to see, or to know, what is taking place in the outer world in the final and supreme test for which a battleship is constructed. Without the *morale*, and the training which will insure a proper performance on the part of what has been called the "black gang," success on the day of battle will become impossible. To assist in this necessary training and instruction the engineering competitions are doing their part. In the development of designs, the investigation of details, and the collection of valuable data for the service, most satisfactory results have been produced.

Engineering

Percentage of Completion of New Warships.—On November 1st, 1913, the vessels under construction for the United States Navy were completed to the following extent: "New York" at the Brooklyn Navy Yard, 92 per cent; "Texas," 96 per cent; "Nevada," 49.2 per cent; the "Oklahoma," 48.7 per cent; the "Pennsylvania," 11.8 per cent; and No. 39, the sister ship to the "Pennsylvania," which is to be built at the New York Yard, is about to have her keel laid.

A 30,000-kilowatt Turbine.—The Interborough Rapid Transit Company of New York city has recently placed an order with the Westinghouse Machine Company for a horizontal turbine of 30,000 kilowatts capacity. The feature of this particular unit will be its division into two turbine elements; the high-pressure element being a single-flow turbine, operating at 1,500 revolutions per minute, and the low-pressure element being a double-flow turbine, operating at 750 revolutions per minute. The machine is of the reaction type throughout, and comparatively low blade speeds are involved.

Danger Signals at Grade Crossings.—The Lehigh Valley Railroad is installing at highway grade crossings danger signals which should prove to be very effective. As soon as a train comes within a mile of the crossing, the signal shows a red light and a gong that can be heard five hundred yards away begins to ring. Both warnings continue to act until the train has passed, when the gong ceases and the red light changes to white. Should the wires become deranged, or should anything happen to the mechanism, the signal on the disk flashes to danger and remains there until repairs are made. Nothing short of actual demolition can prevent the signal from working.

Cucuracha Slide Is Cut Through.—The great Cucuracha slide on the Panama Canal (which, it will be remembered, filled the Culebra cut in the interval between the cessation of excavation and the flooding of the cut with water) has at last been cut through, the opening having reached, according to the last dispatches, a depth of 40 feet below the present level of water in Gatun Lake and in the cut. A vessel carrying certain officials of the road passed through, and now that the large floating dredges are at work, it will not be long before the whole width of the cut has been cleared of the slide.

New Steel Equipment for the New Haven.—The first of the new steel cars ordered for the New Haven road has been received, and by the end of the year it is estimated that twenty-five of these will be placed in service. The car is 80 feet in length, and has a seating capacity of 88 persons. The heating system is regulated automatically by pressure. Each car is furnished with its own lighting system, the current being generated by a dynamo which is run by a belt attached to the car axle. The floor consists of sheet steel with a composition covering that is fireproof, and the cars are also protected from the heat in summer and cold in winter by a heavy insulation of hair felt and asbestos.

A Soot and Dust Gage.—According to the *Electrician*, an organized attempt to measure, by means of instruments standardized by the Smoke Abatement Committee, the extent of the soot and dust existing in the atmosphere of several large towns and cities in the United Kingdom has been undertaken, commencing from the first of the present month. The instrument to be used follows the principle of the rain gage a given area being exposed to catch all solid matter that either falls by gravity or is borne down by rain. This is collected in a glass receiver placed beneath a duct leading from the collecting surface. The receiver will be removed once a month and replaced by a fresh one.

Test of Ashokan Dam Shaft.—With the exception of some finishing work in the Garrison tunnel, the Catskill Aqueduct is now practically completed from High Falls to Hillsville Reservoir, which lies on the outskirts of New York city. On November 11th water from the Ashokan Dam was sent through one of the great shafts of the Aqueduct, namely, shaft No. 1, which is situated at Stone Ridge. The water reaches a point seven hundred feet below the surface, at which level it is carried below the Rondout Valley for a distance of about six miles. The test was completely successful. Other shafts will be tested in the same way, successively, until the whole system has been tried out.

Artesian Wells in Australia.—It is interesting to recollect, says the *Engineer*, that over a very large area of Australia, and especially where the rainfall is light, it is possible to tap an apparently inexhaustible supply of artesian water by boring. In this way much has been added to the value of large tracts of country, both for stock carrying and general productive purposes. Latest developments would seem to indicate that the artesian area is even greater than was at first supposed. For some time the South Australian government has been boring for water on the southern limits of the artesian basin in the neighborhood of Lake Frome, and last month a supply of good quality water was tapped, equal to 230,000 gallons a day.

Electricity

Electric Window-cleaning Device.—According to a press report, Admiral Prince Henry of Prussia, brother of the Kaiser, has invented and patented an electrical device for cleaning the windows of automobiles in rainy or frosty weather. The device is set in operation by the pressing of a button.

Electric Bulletin Board.—A large electric news bulletin board has been erected in Dayton, Ohio, with which news is spelled out in luminous letters measuring 28 by 22 inches. The announcements may be read at a distance of four blocks. The board has a capacity of four lines of fifteen letters to the line, and is operated by a keyboard similar to that of the typewriter.

Electric Vehicle Census.—The Electric Vehicle Association of America estimates that there are 37,000 electric vehicles in use in the United States, of which number about 25,000 are pleasure cars and 12,000 commercial vehicles. Chicago holds the record with 2,850 vehicles. New York with 2,000 comes second, and Cleveland with 1,800 comes third. Forty per cent of New York's motor trucks are electrically driven.

Lightning Conductors on St. Paul's.—New lightning conductors have just been installed on St. Paul's Cathedral in London, and in the course of this work the interesting discovery was made of a part of one of the original iron bar conductors erected about 140 years ago under the supervision of Benjamin Franklin. This bar, which was inside one of the towers and so not exposed to the weather, was still in a good state of preservation.

Motor Trucking at Night.—In his presidential address before the Electric Vehicle Association of America, Arthur Williams suggested that traffic congestion in New York and other busy cities could be relieved by substituting night for day trucking. There is no reason why wholesale trucking could not be done at night. Goods may be moved from the terminals to warehouses and the moving in large quantities of merchandise to the large department stores does not have to be done in the daytime. Mr. Williams even suggests that coal might be delivered to our large buildings at night. When the streets are not occupied by other traffic, greater speed may be maintained and deliveries may be made in less time.

1,200-Volt Line in Holland.—A short interurban traction line is now in operation in Holland connecting Leyden with the two towns of Katwyk and Noorwyk. It runs on the continuous current 1,200-volt system and is standard gage, using double track for the most part. After leaving the city limits, the road reaches the town of Ryasburg three miles away and at this point it divides into two branches which run to the two places just named, these being sea beaches on the North Sea, lying at 5 and 7 miles respectively from town. Current comes directly from the Leyden central station without the use of substations. Trolley wires are held by middle poles between tracks carrying double bracket arms. Trains run every half-hour and are made up of a motor car and two trailers. Motor cars have two end cabins for controllers and carry two 100 horse-power motors which take current at 1,200 volts by pantagraph trolley.

Carbons for Searchlights.—In most searchlights the rays come from the positive crater, and the important point is to have a steady arc. This is about satisfied by the use of a negative carbon of small diameter, but with large apparatus using heavy currents, the small carbon soon becomes red for quite a length and burns up quickly. Should the small carbon be inclosed in a tube, this will cast an objectionable shadow. German constructors reduce the wear of the negative carbon by placing it in gas or vapor containing no oxygen and which takes off the heat. Again, lengthwise or cross grooves in the carbon increase its radiating surface. By using a core in the carbon, of a refractory material, the carbon consumes faster than the core and this produces a fine point. A good method is to use a current of coal gas escaping from a pipe, and this gas can even be lighted without harm. Solids or liquids, such as naphthaline or petroleum, can also be vaporized by the heat of the arc.

A Reading Optophone.—A year ago an instrument was developed which enabled a blind person to discover the whereabouts of windows, lights and light objects, by sound. This instrument, known as the optophone, made use of the varying resistances of selenium cells when exposed to light, and made known the presence of light by means of a telephone. The apparatus has since been improved, to the extent that it is now possible for a blind person to read type. So far the smallest type that may be successfully read is an inch high and it must be photographed white, as a transparency. The letters give various characteristic sounds. As described in the *Electrician*, "the two vertical strokes of H or M give a chaos of notes, the middle stroke of N gives a falling gamut, the three horizontal strokes of E give a chord and the curved lines of O and S give characteristic flourishes of sound. The alphabet of capitals can be learned in about an hour, and once learned, the process of reading may become as rapid as that of reading by sight."

Science

The Humors of Science.—Among the list of new books published in a recent copy of *Nature* we find the following: 'Ist es wahr dass 2x2 = 4 ist'" (Is it true that 2x2=4) by Fred Bon. *First volume 523 pages.* Published by E. Reinicke. We leave it to the reader to make his own observations.

The Return of Peary's Record.—It is reported that the record deposited by Peary in a cairn at Navy Cliff on the northeast coast of Greenland in July, 1892, has been returned by Knud Rasmussen, the Danish explorer who found the record. The Danish government, to whom the record was sent by Rasmussen, has officially transmitted it to Admiral Peary.

The Results of Anti-typhoid Inoculation among the French troops in Algeria and Morocco during 1912 were reported by Prof. Vincent at the recent International Medical Congress in London. In western Morocco, while about sixteen per cent among the non-inoculated contracted the disease, only one in 5,000 among the inoculated did so.

Hann's Lehrbuch der Meteorologie.—There is perhaps no branch of science in which a single text-book holds a more dominant place than does Hann's *Lehrbuch* in meteorology. It is, therefore, interesting to learn from a note in *Science* that a revised edition of this work is in an advanced stage of preparation and will shortly begin to appear in parts. The author expects to complete the work in the autumn of 1914.

Rubber From Wild Lettuce.—A study by C. P. Fox of two species of wild lettuce, *Lactuca canadensis* and *L. Scariola*, both common in the northern United States, shows that the former contains 2.19 and the latter 1.58 per cent of a good quality of rubber. As the plants also contain lactucarium, which is a recognized drug, it is suggested that they might be profitably exploited for both these products.

The Purification of Public Water Supplies.—This is the subject of an important memoir by George A. Johnson, published as Water-Supply Paper 315 of the U. S. Geological Survey. It includes descriptions and illustrations of all the principal filtration plants in the United States, together with a full account of the recently developed methods of water sterilization with hypochlorites, and the methods of water softening used at a number of municipal plants in this country.

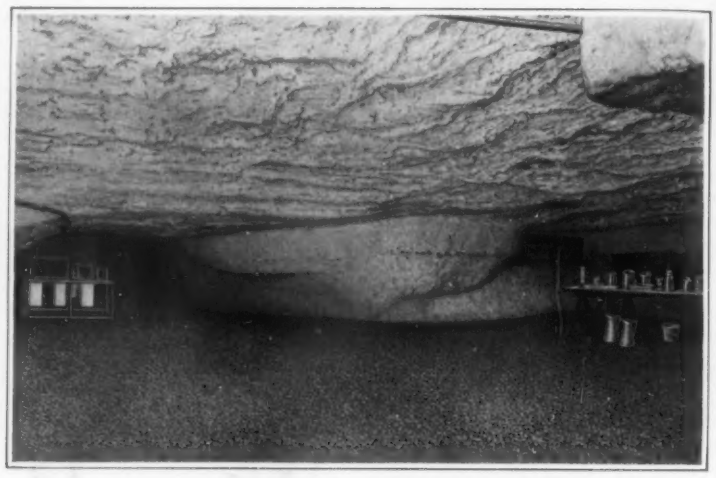
The Chemical Intensity of Sunlight, together with its fluctuations, has been investigated by a great variety of methods, with hardly comparable results. One of the latest undertakings of this kind was carried out at the Hawaiian Agricultural Experiment Station, in co-operation with the Philippine Bureau of Science. Using a solution of oxalic acid in the presence of uranium acetate, it was found that the actinic effect of the sun was highest at the spring and fall equinoxes, and lowest at the summer and winter solstices.

Aerated Waters in India.—A consular report states that the enormous number of Brahmins and Mohammedans in India whose religions strictly prohibit the drinking of alcoholic beverages are finding in aerated water a substitute that violates no religious principle. Among natives of the strictest caste prejudices, who are ordinarily careful not to eat or drink anything that has been prepared by persons of other castes, no objection seems to be raised to aerated waters, which being made by machinery are considered free from contamination.

An International Institute of Social Statistics.—An international institute is being formed to collect and compile figures on subjects which are barometers of financial, industrial, trade or social conditions. It is proposed that monthly figures of the subjects mentioned shall be cabled by the different nations on a given day each month to the office of the institute for immediate publication in a form ready for comparative use by business men. There is no doubt a great scope for work of this kind, and it is to be hoped that the proposed international institute may fulfill successfully this very important function.

Sea Routes to Siberia.—From time to time the SCIENTIFIC AMERICAN has recorded the attempts that are being made to establish regular sea routes to the Arctic coast of Siberia from the European side and also by way of Bering Strait. On August 6th Dr. Nansen left Vardö, Norway, in the steamer "Korreet" for the mouth of the Yenisei River. A Russian government cargo is to be carried to the Yenisei and a private mercantile cargo on the return voyage. As we have previously reported, the Russian authorities recently established wireless stations on the Yugor and Kara Straits to notify vessels whenever these entrances to Kara Sea are free from ice. According to the reports thus received, the "Korreet" will pass through one of the straits mentioned, or through Matyushin Strait, or will circumnavigate Nova Zembla. It is hoped that Dr. Nansen will obtain some tidings of the missing Bruisloff expedition, which undertook last year to make the Northeast Passage by way of Bering Strait.

Zoology Hall arranged for breeding small aquatic animals.



A section of the Vestibule and Zoology Hall.

A Laboratory for Investigations of Underground Life

A Grotto Utilized for the Study of Subterranean Plants and Animals

By Dr. Alfred Gradenwitz

THE organisms inhabiting the bottom of the sea have, until recent times, been omitted from the scope of scientific investigation, and the fauna and flora of caverns, so remarkable on account of their peculiar conditions of existence (absence of light, uniformity of temperature, etc.) have likewise been neglected by scientists until quite recently.

A French naturalist, M. Henri Gadeau de Kerville, in connection with his excavations while searching for remnants of prehistoric man, discovered a large cavern in an abandoned quarry near St. Paer. Being greatly interested in speleology, he decided to prepare this cavern at his own expense as a laboratory for investigating underground life. This remarkable institution, on account of its scientific importance, has created a great interest among scientists in general.

The laboratory is situated in calcareous rock and comprises a staircase, a corridor, a ventilation chamber, a vestibule and the laboratory rooms proper. The last include a zoological and a botanical hall and a back room. Apart from the staircase, corridor and ventilation chamber, the whole laboratory covers an area of no less than 671 square meters.

To the left of the entrance there is a concrete water tank of 2,025 liters capacity. From this the water is conveyed through an underground conduit into two sheet-metal tanks in the zoology hall where aquatic animals are kept. From the entrance door there is a concrete staircase of forty steps leading down to the corridor mentioned above. On the left is the ventilation chamber which, through windows fitted with iron blinds, communicates with the corridor and vestibule. The ventilation of the laboratory is excellent. Even after many hours spent there, one never has the least feeling of being in confined air. Ventilation is effected through the entrance door, the ventilation chamber, a ventilation window in the zoology hall and a large rectangular chimney in the outer wall of the two laboratory halls. This wall is lined with a thick layer of earth and stone to protect it against atmospheric influences. A sunshade on the western window of the botany hall protects this against any reflected daylight liable to enter through the ventilation chimney. Since the laboratory lies in the open country the air in its interior is, of course, of the greatest purity, which is most important in connection with any research work on underground organisms.

In the vestibule there is also a tarred linen curtain which, in bright daylight and especially in the event of the sun rays striking the entrance door, wards off any reflected light. As there is absolute darkness in the two laboratory rooms, there is no need for the walls and ceilings being blackened. In front of the protective curtain is a table for preparing the plants to be used for experimental purposes; behind this table is an insect cage.

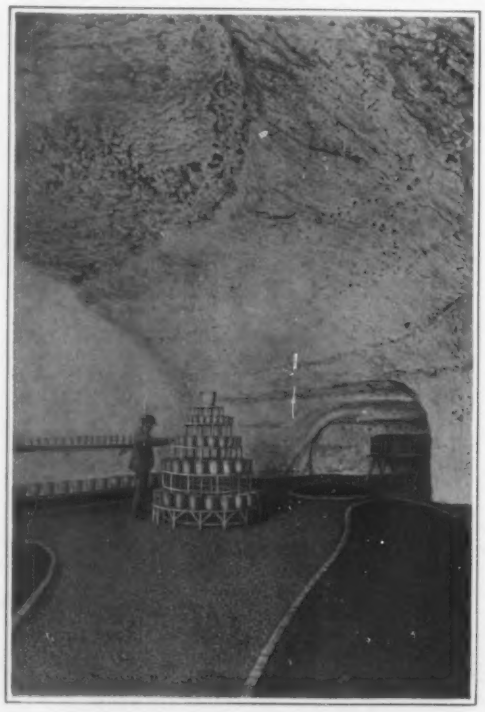
The zoology hall contains four aquaria, the two sheet-metal water tanks above referred to, sixteen concrete troughs, a sink, a concrete slab, and on two long tables twenty-four wooden boxes. Some of the concrete troughs are fitted with lids, thus preventing the animals kept therein from escaping. The water from the four aquaria is discharged through a tap into buckets; a hand pump or syphon serves to renew the water in the iron concrete troughs. Since the air is saturated with moisture there is practically no vaporization of water, and on account of its low temperature the water decays with extreme slowness, thus necessitating a renewal at very rare intervals. On the wall there are several small outlets to the discharge conduit, into which any superfluous water is poured. Candle lanterns with yellow and green glasses are used for lighting. These allow sufficient light to pass, though arresting practically all chemical rays.

The botany hall contains four border-beds containing a layer at least 70 centimeters thick of vegetable soil. There are also provided a small stock of vegetable soil, a shelf 11.60 meters long and 0.65 meter wide, an iron bracket 2 meters in height and a small table. In the back room are stored some insect cages of wood and wire gauze.

The temperature of the air (generally 5 to 9 deg. Cent.) varies only a few degrees in the course of the year, in spite of the excellent ventilation. The water temperature throughout the year is 7 to 8.5 deg. Cent. M. de Kerville does nothing to prevent an increase of temperature in his cavern laboratory. However, when the outside temperature is excessively low, as an additional precaution he puts a straw mat on the entrance door, which, though interfering in no way with ventilation, constitutes an effectual protection against the cold. On account of the uniform temperature, the great moisture of the air and the perfect darkness any plants and animals studied in the laboratory are under practically the same conditions as in real grottoes, and the institution promises to prove of the greatest utility to scientific investigation.

Animal Training by Magnetism

AMONG the various applications of the electro-magnet there is one which, while not altogether free from the imputation of humbugging the public, has at least the merit of much ingenuity, and may suggest other and more creditable services.



Botany Hall, where underground plants are studied.

A genial showman, not so very long ago, happening to see the ease with which a powerful lifting magnet was used to handle material, conceived the idea of employing a similar device to assist the performances of a "trained" elephant. The plan was nothing less than the use of what might be called magnetic stencils, to enable the intelligent beast to appear to solve problems in arithmetic and write answers to simple questions.

It was found entirely possible to train the elephant to take up in his trunk an iron holder containing a piece of chalk, and to move it about over the surface of a blackboard. The problem lay in the conversion of these aimless scribblings into intelligent and correct answers to questions put, either by the trainer or by the audience.

The sight of the lifting magnet gave the showman the clue to his solution. Before long his exhibition included a wagon with a blackboard side, as thin as might be conveniently made, and containing within it a complete equipment of large letters and figures arranged as poles to a powerful magnet, which could be held up against the inside of the blackboard by an attendant. The attraction of these magnetized symbols was sufficient to guide the holder in the trunk of the elephant, as it was aimlessly moved over the surface of the blackboard, and thus the intelligent animal was enabled to impress the admiring audience with his ability to write the sums of small numbers and do other things indicative of the possession of human reasoning powers.

In view of the interest now expressed in intelligent horses and similar animal marvels, it may be of interest to examine the extent to which the latest developments in applied science are being used in such fields as the entertainment of a circus audience. Possibly the explanations which this line of inquiry may suggest will be as entertaining as the show itself, and very probably further applications will occur both to showman and scientist.

Excessive Whaling in the Southern Ocean

WITH the recent great development of whaling in southern latitudes has arisen the danger that some of the favorite whaling grounds will soon be worked out. Thanks to modern methods and apparatus, whaling is much more deadly to-day than it was in the palmy whaling days of the last century; not only are more whales of a given species destroyed in proportion to the number encountered by the whalers, but it is now profitable to hunt species that were formerly not thought worth the attention of whalers. During the year 1911 about 17,500 whales were caught in the southern hemisphere, yielding 500,000 barrels of oil, valued at $8,750,000; and the total catch in 1912 is supposed to have been 10 to 25 per cent greater than in 1911. In South Georgia, where the whaling stations are leased by the British government to a Norwegian firm, 7,000 whales were captured in 1911, the species hunted in that vicinity being chiefly rorquals, which were once left in peace by whalers on account of their relatively small yield of oil and whalebone. The British Colonial Office has just sent Major Barrett-Hamilton to this whaling ground to ascertain whether the whales stand in danger of extermination. He is accompanied by a taxidermist of the British Museum, who will bring back specimens for the Museum.

What Is Old Age?

Carrel's Research on the Mechanism of Physical Growth

By Genevieve Grandcourt

(Photographs by courtesy of *Journal of Experimental Medicine.*)

IN considering the significance of the study of artificially grown connective tissue as it applies to the problems of development and decay, it is well to keep in mind that this is the supporting tissue of the body; the other fundamental tissues being two in number—the one from which the skin and nerves develop, and the one which makes up the gastro-intestinal tract and the organs which have to do with supplying food and oxygen to the body.

The function of connective tissue is not uniform. It comprises bone, cartilage, ligaments, etc. From it, also, is grown the network through which the lymph passes. The cells in this network are endowed with special properties of growth and play a most important rôle in bringing about repair when tissue is injured; they, in fact, form the scar in the wound.

According to the work assigned it, the texture of connective tissue varies; it may be in whole or in part composed of fibers or elastin, or its structure may be consistently intracellular. Occasionally, the preponderance of elastin in the fibers converts it into true elastic tissue, significant of its mechanical adaptation.

Approximately three quarters of a century ago the origin of tissue was definitely ascertained by Schleiden and Swann to be the work done (in process of division) by the individual cell. Brown had already discovered the cell nucleus, and Wagner had said the egg was only a cell.

Claude Bernard made known the law that forms the starting point of Carrel's investigations, i. e., that the life of an organism is dependent upon the interactions of its cells and of the medium in which they grow. Thus the problem of understanding the means by which the body develops, and why it must undergo (at least in our present state of knowledge) more or less early deterioration and death, resolved itself into learning the character of these interactions. This was obviously impossible until the wonder was wrought of growing tissue outside the body, and so making the process susceptible to detailed microscopic observation and experiment.

Carrel's first efforts after his success in keeping these tissues in a state of indefinite multiplication ("permanent life") were directed to studying the manner in which the medium affects the life of the cells.

The earliest medium was specially prepared blood (plasma) from full-grown dogs or chickens. It was soon apparent that the older the animal from which the blood was taken, the less rapidly and extensively the tissue grew in it, while in the blood of the relatively old animal, the increase became so slight as to be practically *nil*.

Comparative experiments were then made between the effects of the plasma of animals whose ages were respectively five months and five years. The results showed enormously greater activity on the part of the blood of the growing animal, the rate being sometimes half as much again.

The conclusion reached was that when an animal attains its size (that is, when its tissue stops growing), its blood undergoes progressive changes until it lacks more and more and at last nearly all of the dynamic power of youth.

Now, the question was whether the old plasma could be given the force of the young, so far as its activity on growing cells was concerned. This was accomplished by mixing it with juices extracted from the embryo. When the plasma of young animals was modified in the same way, a greater proportional increase in its activating power resulted. In this connection an interesting series of experiments was made with a strain of connective-tissue cells which had been kept in artificial life for more than sixteen months.

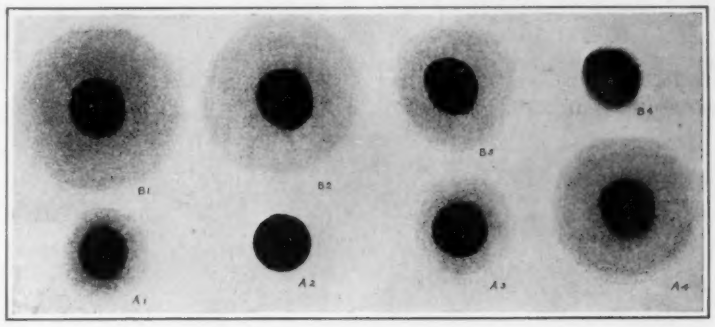


Fig. 1.—Showing comparative rate-growth of tissue respectively in plasma (above) and when the plasma is mixed with juice of embryo.

A^1 and A^2 grown in plasma, B^1 and B^2 in mixed medium. In A^3 and A^4 and B^3 and B^4 the conditions were reversed.

It was divided into two parts, *A* and *B*; *A* being grown in adult plasma, while *B* was placed in a medium composed of two parts plasma and one part embryonic juice. In two days, the ring of new tissue around *B* was three times greater than that around *A*. The cultures were then washed in salt solution (this particular process being the condition of their "permanent life"), and the experiment was repeated. *B* grew practically at the previous rate, but *A* was stationary. (See Fig. 1.)

Tissue passed through salt solution 130 times doubled its area in 48 hours. Another growth washed 87 times increased its volume 15 times in 10 days. Still another, under special conditions, augmented "more than fifty times in six days."

These rapid growths, however, could not be duplicated in normal plasma, the further modifying of which was undertaken. In one case it was diluted, in another substances were added to it, or again its reactive power was changed or its osmotic tension made greater or less. By measuring the extent of the new growth accumulated between passages through salt solution, it was easy to estimate the varying effects produced by the different media. The relation between the extent of the growth and the particular character of the medium was always the same.

Dr. Carrel says:[1] "As the rapidity of growth of a tissue depends so much on the composition of the medium, it may become possible to use as a reagent of the dynamic value of the humors of an organism, a strain of cells adapted to life *in vitro*.[2] If human connective tissue cells could be preserved in a condition of permanent life, as connective tissue cells of the chicken are preserved, the value of the plasma of an individual might be appreciated[3] by the cultivation in it of a group of these cells and by the observation of the rate of their multiplication. These observations would perhaps give some indication of certain values of the blood of an organism and possibly some clew to its age."

It became evident, in the course of experiment, that the activity of tissues was apt to vary, alike in the same body and in their own parts. Was each particular condition permanent, or did the dynamics of the cells change through the action of the medium upon them?

To determine this point, several pieces of tissue, each having its own peculiar dynamic power, were cultivated in media exactly alike. For a time, differences in the character and extent of the growth were marked. Then the influence of the medium began to tell. Measurement of changes undergone on the part, in turn of a fast and of a slow growing tissue, showed that the former had lowered its activity one half in forty-eight hours, while in the same length of time, the latter had multiplied its activity by six. This process continued until the level of uniformity was reached when the conditions of growth remained equal in all cases.

Therefore it was evident that though in the beginning certain substances which the tissue had accumulated had the effect of accelerating or retarding (as the case might be) its activity in the medium, yet in the course of time, the medium operated to overcome these conditions and bring the growth under the laws of its own special mechanism.

Further experiments were tried, some with cells whose growth was stationary. Results all pointed to the same conclusion.

Thus the sum of investigations on the influence of

(*Concluded on page 420.*)

Fig. 2.—Seven-day incubator growth.

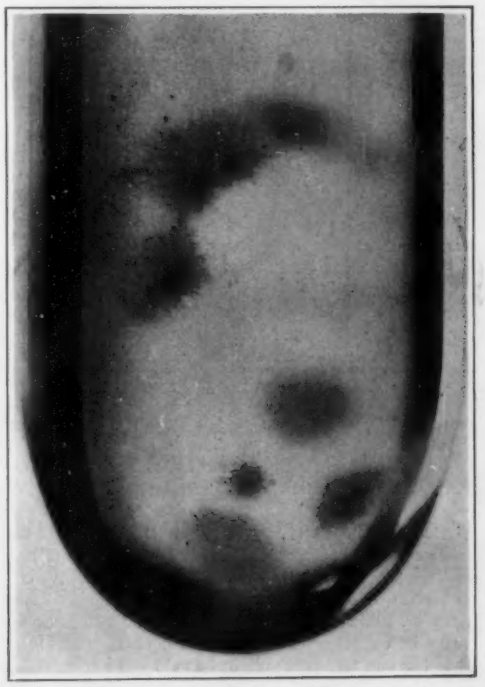


Fig. 4.—Showing a forty-eight-hour growth of tissue (from a test tube cultivation aged fourteen months).

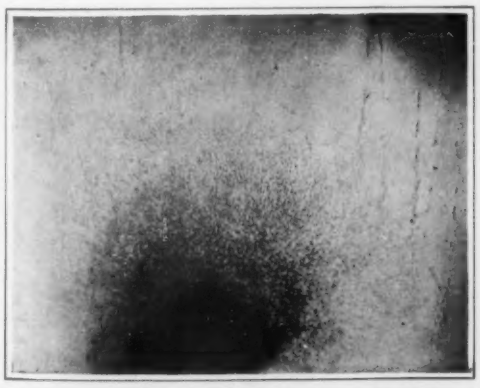


Fig. 3.—Seventy-two-hour growth (after being passed 155 times through salt solution and washed one month).

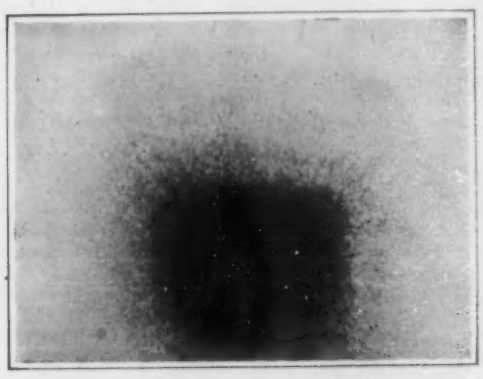


Fig. 5.—Seventy-two-hour growth (after being passed 155 times through salt solution, but not washed in it as in Fig. 3).

[1] *Journal of Exp. Med.*, vol. xviii, 1913.
[2] Artificial life. [3] Estimated (?).

The Mobile Army of the United States

Its Organization, Equipment and Method of Operations

By a Major of the United States Army

THE Regular Army of the United States in time of peace consists of thirty regiment of infantry, fifteen regiments of cavalry, six regiments of field artillery, and the coast artillery, together with the various auxiliary troops and staff departments. The auxiliary troops comprise the engineer, signal and sanitary troops. The staff departments are the General Staff Corps, the Adjutant General's, Inspector General's, Judge Advocate General's, and Ordnance Departments; Quartermaster, Medical, and Signal Corps; the Corps of Engineers; and the Bureau of Insular Affairs. In addition there are the Professors of the Military Academy. The Philippine Scouts and the Porto Rico Regiment of Infantry are also a part of the Regular Army.

The infantry, cavalry, and field artillery, together with the proper proportions of auxiliary troops and of the staff departments, compose the Mobile Army which is available at any time for service in the field, that is, anywhere it may be desirable to send them. These are the troops which would be organized into armies to invade a foreign country or to repel invasion.

The Coast Artillery Corps is a technical arm specially trained to handle the large cannon and the submarine mines intended to prevent a hostile navy from entering our harbors and capturing our seacoast cities, naval stations and depots of supplies. These troops are trained to a certain extent as infantry and might be so used in an emergency. As, however, their special work is too technical to permit of their being readily replaced, and as their withdrawal would require that the navy should remain at home to protect our ports rather than to seek the enemy's navy, knowing that it had a secure base behind it, the use of Coast Artillery as part of the Mobile Army cannot be relied upon. The present strength of the Coast Artillery is about 800 officers and 15,000 enlisted men. The men are armed with the infantry rifle, and, as previously explained, are drilled to a certain extent as infantry.

The Philippine Scouts are recruited from the natives of the Philippine Islands. The company officers are mostly Americans, principally ex-non-commissioned officers of the regular army. There are a few native company officers. The senior officers are officers of the regular army, specially detailed for this duty. The present strength is about 5,000 officers and enlisted men.

The Porto Rico regiment of infantry consists of two battalions of four companies each. The officers are obtained in the same way as for the Philippine scouts, and the enlisted men are all natives of Porto Rico.

The mobile army is organized into four divisions and a cavalry division. Of these troops, three divisions and the cavalry division are within the territorial limits of the United States, except such troops as are in the Hawaiian Islands, Alaska, and Panama. The other division is in the Philippine Islands.

The company, the troop, or the battery, depending on the branch of the service, is the basis of organization, that is, the smallest tactical and administrative unit. The infantry company consists of one captain, one first and one second lieutenant, and seventy-five enlisted men. This is the peace strength. The men are now supplied with the newest prescribed equipment, and are thoroughly ready for effective field service.

The troop, the smallest cavalry unit for administrative purposes, is commanded by a captain, assisted by one first and one second lieutenant, and has an enlisted peace strength of sixty-five men. The men are armed with the rifle, pistol and saber, and are trained to fight either on foot or mounted.

The battery is the smallest administrative and tactical unit of the field artillery. It is commanded by a captain, assisted by two first and two second lieutenants, and on a peace footing has an enlisted strength of one hundred and thirty-three men. Each battery is charged with the handling of four guns, either light (3-inch) or mountain (2.97-inch). Ammunition for the light batteries is carried in caissons, each drawn by a team of six horses. Ammunition for the mountain guns, as well as the guns themselves, is carried on pack mules. The officers, non-commissioned officers and a few specialists only are mounted, the remainder of the command travels on foot. In the light batteries the entire command rides. Officers, non-commissioned officers, drivers and certain specialists are horsed. The cannoneers all ride on the carriages. The weight behind each team horse amounts to about one thousand pounds. Compared to loads behind draft horses in civil life this does not appear to be much of a load, but it must be remembered that at certain times high speed is required of the artillery animals, not to speak of poor roads, broken country and other difficulties seldom met with in ordinary commercial traffic.

When taking to the field, each company and each troop is supplied with one escort wagon drawn by four mules. Each battery is furnished with four such wagons, two drawn by horses from the battery and two by mules. All wagons and all mules are the property of the Quartermaster Corps of the Army.

We have touched in a general way on the smallest tactical units of the service. There exist in addition the Engineer, Signal and Sanitary troops.

These troops are all organized into companies and battalions. The engineer troops are charged with pioneer work, such as road repairing, repair of bridges, clearing away of obstructions in the nature of wire entanglements, blocked roads, etc., as well as the transportation and use of bridge material for the construction of pontoon bridges. The actual construction of trenches and other light field works is the task of the troops that will use them, but in cases of siege or siege operations, the engineer troops aided by civilian labor will have entire control of the execution of the work.

Communication between the larger elements of a command from Army Headquarters through the divisions to the brigades is maintained by the Signal Corps troops, by means of wireless telegraph, ordinary telegraph, telephones, lanterns, rockets, etc. This work is technical as well as tactical, and has been brought to a very high state of efficiency. The instruments in common use are excellent in character and of a kind thoroughly suited to field work.

The sanitary troops are distributed among the various regiments of infantry, cavalry and field artillery. Their duties pertain to the battle field. Besides those so detailed there are ambulance companies and field hospitals, controlled by the Medical Corps, for the transportation and care of the wounded after first aid has been administered at the regimental dressing stations.

From the companies, troops, and batteries we advance to the battalion and squadron. The infantry battalion includes four companies and is the command of a major, assisted by his staff—one adjutant, one quartermaster (both lieutenants). The cavalry troops are organized into squadrons of four troops, commanded by a major with the same staff officers as the infantry battalion. The artillery battalion embraces three batteries. The battalion and squadron are merely tactical (fighting) units.

Battalions and squadrons are grouped into regiments. In the infantry and cavalry three battalions or three squadrons, while in the field artillery two battalions make a regiment. Regiments have a distinct designation, and are permanent organizations. Each regiment is commanded by a colonel, assisted by the lieutenant-colonel and the regimental staff, consisting of one adjutant and two supply officers. Each regiment of infantry and cavalry has its own machine gun company armed with four Colt machine guns. To each regiment is assigned a chaplain, medical officers and sanitary troops.

The regiments are further grouped into brigades of infantry, cavalry or field artillery for tactical purposes. Brigades normally consist of but one branch of the service, so that they are spoken of as infantry brigades, cavalry brigades, etc. A brigade is the command of a brigadier general. He is allowed a brigade adjutant with rank of major, and two aids, with the rank of lieutenant.

These brigades are in turn grouped to form the division. A division is normally organized as follows: One major general, commanding; his staff, consisting of one chief of staff (colonel), one assistant chief of staff (major or captain), one adjutant (major), one inspector (major), one judge advocate (major), one quartermaster (lieutenant-colonel), one division surgeon (lieutenant-colonel), three aids (captains or lieutenants). Commanders of the engineer and signal troops may be required to serve at division headquarters in the capacity of division engineer and division signal officer. The fighting forces and their auxiliaries are as follows: Three brigades (infantry), one regiment of cavalry, one brigade of field artillery, one pioneer battalion of engineers, one field battalion of signal troops, four ambulance companies, four field hospitals; also for purposes of supply: one ammunition train, one supply train (wagons), one pack train.

The organization of a division is the result of long years of experience, both in this country and abroad. It is the one force that might be said to be rounded out. It is really a small army of about twenty thousand men, and is self-sustaining. The infantry is the preponderating force, naturally, for infantry bears the brunt of every battle. No enemy can be shot out of a position. In the final period of an attack that which brings success or failure is the ability of the infantry to gain hand to hand contact with the defenders, necessitating tremendous loss of life. This contact may not literally come to pass, but the desire and the willingness to gain it must exist in such degree that the enemy will realize it.

A command composed of two or more divisions with complements of heavy and siege artillery, bridge trains, an additional force of infantry and cavalry, and the necessary supply and ammunition columns, constitutes a field army and is the appropriate command of a lieutenant general. A field army is designated numerically. A command composed of two or more field armies constitutes an army. It receives a territorial designation, and is the appropriate command of a general. Field armies and armies are created only by authority of the President.

When an army, field army or division moves against a hostile army, or against some other objective, it operates from a base. The line joining the army and this base is called the line of communications. As the army advances, sufficient force must be left to guard this line.

The army is preceded by its cavalry, which keeps a day, or even as much as three days' march ahead, forming a screen for the purpose of warding off efforts of the opposing force to gain information, and at the same time endeavoring to penetrate the hostile screen and gain information. This cavalry acting alone, sometimes accompanied by artillery, is called the Independent Cavalry. Behind the Independent Cavalry comes the Advance Cavalry. This cavalry operates in groups from the size of a patrol of from four to eight troopers to a troop itself, and is used for the purpose of strengthening the screen at vital points, and to reconnoiter distant points that forces of the enemy may have become lodged in, in order by such reconnaissance to prevent surprise of the main body.

At a distance of several miles from this advance cavalry marches the Advance Guard composed of infantry and field artillery, and behind the Advance Guard the Main Body, composed of the great bulk of the troops, followed by the trains and finally the Rear Guard. The flanks are protected by Flank Guards or Patrols.

In a large command the size of an army, one road of course would not accommodate the force and enable it to be placed in action to the front within a reasonable time to be serviceable. Hence, with such a command, several parallel roads would have to be used for the advance, each field army having its own. When an army moves in such formation, the independent cavalry still remains under the direction of the supreme commander, but each force on the separate roads would control its own advance cavalry, advance guard, etc. Communication between columns would be maintained by contact patrols, bodies of troops detailed for such purpose.

The independent cavalry having gained information of a vital nature, the advance is continued for the purpose of gaining contact. The advance cavalry may at this point merge into the independent cavalry, though not necessarily. Later the advance guard comes into the action with its infantry and field guns, occupies the position seized and held by the advance cavalry, which withdraws, while the action is developed by bringing up reinforcements. Usually when the reserve of the advance guard goes into action, the artillery is committed also. It begins its firing at ranges of from two to three thousand or even four thousand yards. In an advance of this kind, the object is to continue, and the problem resolves itself into driving the enemy from his position, either by actual force or strategy. In the former case, it is vital to get as close to the enemy as possible. It has been stated before that an enemy cannot be shot out of a position; he must be driven out at the point of the bayonet, or at least the *morale* of the hostile force must be so lowered that when hand to hand fighting becomes imminent it will fall back. To accomplish this the artillery is brought strongly into play. Its function is to silence the hostile artillery. If this cannot be done, it must nevertheless neutralize the hostile artillery's fire by drawing it to itself and away from the advancing infantry. In addition, as the attacking infantry gets within the zone of effective hostile infantry fire, this infantry fire must be stopped in order that the foot soldiers of the attacking force may advance. The artillery has, therefore, a very important part to play, for the entire body of troops

advancing cannot shoot. Infantry in these days advances in small groups, so that while some are moving toward the hostile position, those remaining stationary take up fire action aided by the artillery. The more intense this fire action, the greater chance there is that the enemy will remain well down behind his trenches, in which case his fire is not effective. When infantry has gone as far as it can at one time, it is compelled, for its own protection, to dig shallow trenches and remain in this position until reinforcements for the firing line can be sent forward. This is a very critical time, and it has happened that troops have arrived at the hostile line entirely exhausted and opposed by such fire action that the sending of reinforcements has been practically impossible. But if the artillery of the attacking army has been in sufficient force to silence or neutralize hostile artillery fire, and to aid in keeping the hostile infantry well down behind their trenches, its own infantry should eventually arrive at the enemy's position well able to drive home the final attack. Before this final attack, bayonets are fixed and the position is then carried as in ancient days by the personal valor of the individual soldier, using his gun as a spear or a club.

When the enemy is driven out, the cavalry which at the commencement of the battle is held on the flanks for emergencies is rushed in to complete the rout and carry on the pursuit.

The infantry and cavalry are armed with the Springfield rifle, to which may be attached a bayonet. The bayonet is issued to the infantryman only. The cavalryman has instead a revolver and saber.

The Springfield (or United States) rifle is a 0.30 caliber rifle manufactured at the Springfield Arsenal. It has a steel barrel twenty-four inches long, the rifling inside consisting of four plain grooves 0.004 of an inch deep, the grooves being somewhat wider than the bands, and having a uniform twist. The barrel is incased in wood and held to the stock by means of steel bands. It contains a magazine holding five rounds of ammunition. The magazine can be filled and locked and the rifle carried in this position in perfect safety. When it is desired to fire, the magazine may readily be unlocked and the rifle by one operation of the breech-bolt loaded and cocked. This rifle is capable of being fired 10 to 15 times per minute, depending on the degree of training and experience of the person firing it.

The bayonet is of forged steel, sharpened the entire length of the lower edge and for five inches back from the point on the upper edge. This weapon can be used for thrusting or cutting.

The 3-inch rifle with which the field artillery is equipped is a built-up gun of nickel steel, of the long recoil type. It consists of a tube, jacket, locking-hoop and clip, assembled and mounted on a cradle in which the recoil mechanism is held. This cradle is in turn attached to a rocker which connects the upper parts to the carriage. Part of the recoil is taken up by a cylinder filled with oil, part by means of steel springs surrounding the cylinder inside the cradle, and part along the trail which engages in the ground by means of a spade. After the first shot or two the gun carriage remains practically stationary. The carriage is equipped with a panoramic sight and quadrant for firing over a mask such as a hill or other obstruction.

The rate of fire is about ten rounds per minute. The ammunition is "fixed," that is, the projectile is fitted into a cartridge case of brass containing the powder charge and primer. This gun fires shrapnel and high-explosive shell.

The present strength of the mobile army is about sixty-five thousand men. This force would be increased in time of war, first by calling in the regular army reserves—a few thousand men; second, by enlisting the different organizations up to their war strength with untrained men. This would give a regular mobile army of about eighty-five thousand. A further increase would be made by calling for volunteers, a practice with which the American people are familiar. These would come, first, from the organized militia, a body of partially trained men about one hundred thousand strong; and second, from the mass of the people, totally untrained. If the volunteers did not furnish sufficient men, resort would be had, as in the civil war, to conscription.

Mending Celluloid

THE immense variety of articles made of celluloid for domestic and personal uses gives value to a simple recipe for mending such articles when broken. This consists in dissolving fragments of celluloid in acetone, applying the resulting solution to the broken edges like glue and then pressing them together. The solution is made in a few minutes and "dries" or hardens within a quarter of an hour. If neatly done it is almost impossible to detect the location of the break. The same method may be used for making small objects, such as boxes, trays, picture frames, etc., from sheets of celluloid. The solution may easily be twisted any desired shade also.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Sterilizing Water by Ultra-Violet Rays

To the Editor of the SCIENTIFIC AMERICAN:

We note that you have published on November 1st, page 336, an article on Ultra-violet Rays. In this article we regret to have discovered some errors, which we beg you to rectify in your next number.

Your description of the competitive tests in Marseilles, as well as the picture of the apparatus which you give on that same page, leads the reader to believe that the apparatus tested in Marseilles, and shown in the figure, was the apparatus of Courmont-Nogier. I refer you to the *Comptes Rendus* of the French Academy of Science, October 17th, 1910, where this apparatus has been described by Messrs. Henri, Helbronner, and Recklinghausen. I also refer you to the official report of the Municipal Water Commission of Marseilles, page 57, where it is said that the apparatus was of the system of Messrs. Henri, Helbronner, and Recklinghausen.

I suppose I need not go into the question of patents which only confirm that the apparatus shown in your publication and put on trial during the famous Marseilles test was of the system of which the undersigned is one of the inventors. MAX VON RECKLINGHAUSEN.

New York city.

Are Men Better Typists than Women?

To the Editor of the SCIENTIFIC AMERICAN:

The very interesting and timely article in your edition of October 25th, by Jacques Boyer, bearing on scientific tests to prove whether men or women make the most efficient typists, has won my attention, as the greater part of my life has been devoted to teaching both boys and girls the art of properly manipulating the typewriting machine.

Naturally, from my standpoint, an argument must come from the practical side of the question, for, prior to the SCIENTIFIC AMERICAN's publishing that tests have been made by scientists with instruments, the real depth of the question had not been considered. Mr. Lahy, in his article which opens up so interesting a point of view, does not seem to have settled the question of the relative efficiency of the two sexes to his own satisfaction through the agency of scientific instruments, for he says, in his closing paragraph:

"These conclusions, however, are based upon too small a number of observations to allow them to be affirmed positively and with conviction. The results here given are merely indications which may be confirmed or invalidated by future researches."

It is not my purpose to endeavor to invalidate the researches written of by M. Boyer, but at the same time I may be able to present a few points on the practicability of typists in general which may be interesting to the SCIENTIFIC AMERICAN and help to illuminate some of the dark spots which the scientists have failed to brighten.

In determining whether men are better typists than women, the history of typewriting and typewriting contests should be, we think, a paramount consideration. Such a history has never been written, but the general facts have been fairly well recorded in the pages of magazines devoted especially to the interests of typists and typewriters.

When typewriters were first introduced, women found a new vocation. The field was at first somewhat evenly divided between the sexes, but of late years women have almost wholly displaced the men in this line of work. Is not this fact in itself an indication of the survival of the fittest?

The size and shape of the hands and fingers undoubtedly play an important part so far as adaptability to the use of a typewriter is concerned. If mere strength were the only requisite, then the advantage would certainly be in favor of the men, whose fingers are generally larger and stronger than those of the women. But the man with extremely large and strong fingers is often at a disadvantage when operating a typewriter because the very size of his fingers makes it difficult for him to manipulate the keys. In this respect women have a distinct advantage, as their fingers are more slender and better adapted to the manipulation of the keys. Because a man has large fingers does not, of course, mean that his fingers are not quick in their actions, but that they are not so well adapted to the keyboard. This is especially the case when all the fingers of the hands are employed in striking the keys, which is the only scientific method of operating a typewriter. Some of the fastest shorthand writers in the world have large hands and fingers, but they almost invariably employ a woman typist when making the transcript of their shorthand notes.

As early as 1888 the Canadian Shorthand Society organized a typewriting speed contest to decide who, among the many claimants, should be entitled to the world's championship. This contest was held on August 13th, and was won by Miss Mae E. Orr of New York city. One of the opponents of Miss Orr was the celebrated Frank E. McGurrin. The fact that Miss Orr defeated McGurrin and all the other aspirants for the title settled for many years the question of the world's championship and demonstrated the special aptitude of women for this class of work.

Various methods of learning the operation of the typewriter were advocated in the early days, but it was several years after the Toronto contest before what is now known as the "touch" method became generally recognized as the only scientific way in which the highest degree of efficiency could be attained. Miss Mae Carrington won the blindfold championship, but was the Pan-American Exposition at Buffalo and at various conventions throughout the country, became well known as the fastest and most accurate typist in the world. No mere man was conceded to be in the same class with Miss Carrington.

However, in 1905 a series of speed contests were held at the Business Show at Madison Square Garden. Miss Carrington won the blindfold championship, but was defeated by Mr. Paul Munter and Miss Rose L. Fritz in the half-hour copying contest. In this contest there were two preliminary trial contests of five and ten minutes each, in both of which Miss Fritz was far ahead of the other contestants. In the final contest Mr. Munter was just fifteen words ahead of Miss Fritz. Had the final results included the five and ten minutes' contests, Miss Fritz would have won over Mr. Munter by a good margin.

In 1906 Miss Fritz won the world's championship at Chicago, and in the same year successfully defended her title in contests held in Boston and New York. The Eastern Commercial Teachers' Association held a series of contests in 1906, 1907, and 1908. In all, six contests were held, three for the world's championship and three for the world's school championship. All of these contests were won by the gentler sex.

From 1907 to the present year an annual typewriting contest has been held in connection with the Business Show at New York for a thousand dollar trophy, representing the world's typewriting championship. This trophy was won three times in succession by Miss Rose L. Fritz, then Mr. H. O. Blaisdell won it twice in succession. In 1912 Miss Florence E. Wilson won the trophy, writing at the rate of 117 net words a minute for one hour. This wonderful record was eclipsed by Miss Margaret B. Owen on the 21st of October last, when she wrote at the rate of 125 net words a minute for one hour, thus winning the trophy, and the title of world's champion typist.

Conclusions to be of any value must be based upon correct premises. That thought came to us when reading M. Lahy's article. Were the premises correct? The subjects examined by M. Lahy consisted of six women and five men. The women had from two to four years' practice in typewriting, whereas the experience of the men ranged from two to eight years. Would not the additional years' experience of some of the men add materially to the conclusions in favor of the men? Did the investigator choose the typists because of their experience as all-round expert typists, or did shorthand writing have any part in making the selections? If a typist is engaged only in copying work, should his auditory reactions be considered in the results? Another important question which arises relates to the machine. What machine did the various typists whom M. Lahy examined use? Did they all use the same style of machine? Was the experience of each of these typists confined entirely to the same machine, or were some familiar only with a particular machine, and others familiar with several styles? Would M. Lahy consider familiarity with several styles an advantage or disadvantage in making the experiments? These are only a few of the many questions which readily suggest themselves to any one familiar with the work of typists from every point of view.

The fact that nearly all of the world's work in this line of endeavor is in the hands of women, and that in open competition for so many years they have carried off the premier honors, seems to us to be worthy of consideration and to entitle women to be considered equal, if not superior, to the opposite sex as typists.

New York city. C. E. SMITH.

(Author of Practical Course in Touch Typewriting.)

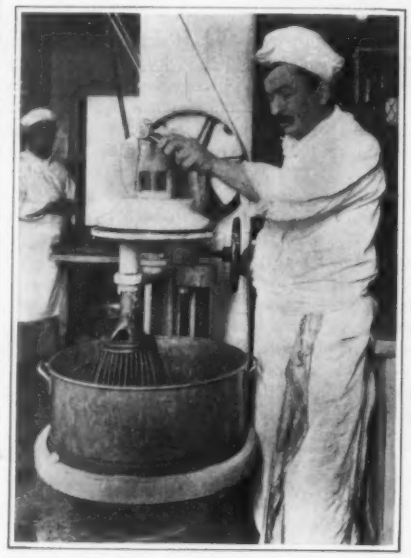
Hudson Bay Fisheries are to be thoroughly investigated from a commercial standpoint by the Canadian government, as it is expected that with the opening of the Hudson Bay Railway a large fishing industry will be developed. The number of steamers entering Hudson Bay this year from the Atlantic has been the largest on record, including two which brought cargoes of pitch pine all the way from Mobile, Ala., for use at the railway terminal under construction at Port Nelson.

Automatic tea-measuring machine.

Labor-saving Appliances of the Modern Great Hotel

Housekeeping on a Manufacturing Scale, Where Mechanical Devices are Used for Everything, from the Boiling of an Egg to the Rolling of a Butter Ball

By Joseph B. Baker



Mixing a batch of mayonnaise.

THE running of a modern great hotel is something more than housekeeping on a gigantic scale: It partakes of the nature of a manufacturing business. The volume of work involved in providing eighteen or twenty hundred guests with food, lodging and entertainment makes simplified methods as necessary as systematized management. The operation of a restaurant or ordinary large hotel is generally like domestic housekeeping magnified. The proprietor needs as much room as possible for tables, that pay revenue, and the cramped space allotted to the kitchen is crowded with cooks and dishwashers and hurrying waiters, with perhaps here and there a time-saving appliance tucked away in a corner. But in the great hotel radically different methods must be employed. The army of hotel servants, the great store of supplies, the intensely active business that goes on in the underworld of the hotel imperatively requires space and therefore allows room also for the installation of mechanical aids in speeding up the work.

In the conduct of the hotel the ideal is to approximate the service and atmosphere of the well-ordered home. It is to help attain this ideal that special machines or devices are to be employed. Incidentally such appliances must justify the room they occupy and the capital invested in them by doing the thing, whatever it may be, with efficiency and economy comparing favorably with the ordinary methods.

The appliances that are actually used to meet this need are of three general classes, according as the economy effected is primarily a saving of time, labor or material. Many appliances which save time primarily are found in the food-service and housekeeping departments of the hotel. The automatic egg boiler, actuated by clockwork (driven by a lead weight) or a small electric motor, figure largely in the serving of breakfast. This ingenious appliance is one of the few which are found in medium and large-capacity restaurants also; because it saves well-nigh 99 per cent of the time and attention connected with boiling eggs to the patron's order and occupies very little room. Suppose a waiter has an order for 2-minute eggs. By a single movement the operator of the egg boiler places the eggs in a metal basket and lowers them into a tank of boiling water at the bottom of the appliance and sets the index at the 2-minute mark. Then he can forget it, for at the expiration of the time set the eggs are lifted automatically clear of the water and a bell may be rung also to call attention. At the busy breakfast hour the gang of egg boilers is in active use and their value in time saving is impressively apparent.

The slicing of bread is an opportunity for a machine to give satisfaction to guests by a uniform product in addition to saving material. As often happens where mechanical devices are employed to replace hand labor, this machine has its own way of doing the work, differing from the primitive hand method, viz., by the motion of a circular knife which divides the loaf by a smooth "draw cut," the loaf being advanced just the thickness of a slice after each cut. The cold meat slicer works on a similar principle, and its work is far more important to both guest and host, on account of the higher cost of meat. The cold meat to be sliced must be made ready by removing the bone; after that is done an inexperienced boy can in a few minutes transform the joint into a pile of slices of identical thickness and as attractive to the guest as the work of an expert carver. The vegetable parer used principally for potatoes and carrots, is a striking instance of a power-driven machine which "peels" by a special method replacing the paring knife of the hand worker. A sack of potatoes emptied into the hopper of this large machine are scraped by attrition against a revolving abrasive disk instead of by the action of a blade and come out of the machine in their original shape without waste and needing only a few touches with a knife to remove the "eyes." This machine is eminently a time saver on account of the large quantities of potatoes consumed and its capacity for work would doubtless cause it to be used in the average large restaurant were it not that space can not be found for it under present conditions of crowding, as already indicated. The apple parer and corer, usually hand operated, turns out cooking apples ready for the chef and requiring no further attention by hand labor; removing the peel by a blade which is usually adjusted to take a deep enough cut to remove surface blemishes also, the idea being that time saving is more important than to get the exceedingly thin paring obtained by hand work by the careful and thrifty housewives of a former day. Under present conditions the balance between the cost of a barrel of apples and the wages of hand workers makes the employment of a machine of this type a genuine economy.

Apart from appliances for handling food there are several instances of time saving in the food serving and housekeeping departments of the great hotel. The telautograph ably supplements the intercommunication service of the telephone, saving time for messages which do not require direct conversation between sender and receiver. For instance, this instrument is employed to expedite the service of meals in the main restaurants of the hotel and also in the private apartments of guests. The written record, a reproduction of the original handwriting inscribed at the transmitting instrument, not only saves time but prevents confusion and errors in the waiters' work. In the main dining-room the waiters may give their orders to an "announcer" stationed just beyond the kitchen door. The announcer, instead of calling out the order (as is ordinarily done) picks up the pen of the telautograph and writes it legibly for transmission to a receiving instrument installed a hundred feet or more away, under the eye of the kitchen foreman. This man tears off the messages as they come in and hands them to the cooks and servers; so that by the time the waiter has arrived in his turn at the serving counter his complete order may be ready on a tray accompanied by a check. The instantaneous transmittal of a written record answers equally well in the serving of meals in the rooms of guests. A late riser, for example, has only to step to his telephone and tell the branch exchange operator what he wants for breakfast—making his selection from the daily menu card. The operator writes the order on her telautograph, and it is reproduced on one of a gang of receiving telautographs in the kitchen. The message is simultaneously reproduced on two other receiving instruments, viz., for the floor clerk for his supervision of the order, and for the floor waiter for him to get his table service ready. The time gained enables the guest's breakfast to be delivered to him in a few minutes via electric dumb-waiter. The telautograph transmits notice of a guest's departure simultaneously to several different departments of the hotel, viz., to the room clerk to inform him that the room will shortly be available for another guest, to the floor clerk so that the room may be put in order, and to the housekeeper's office for general supervision of the maid's work.

Electricity has an interesting application in the maids' service to rooms. Every maid on coming on duty is given a numbered electric plug. On entering a guest's room to put it in order she inserts this plug in a springjack at the door causing a little incandescent lamp to light up in the plug as a signal that a maid is at work within. The jack contact also causes a lamp to light up on the telephone operator's switchboard, informing the operator at all times as to the location of the maid; so that in case a guest calls for a maid for any special purpose the operator can send the nearest available one to her room immediately. Another circuit from the room jack causes a lamp to glow on a panel board in the housekeeper's office so that the housekeeper knows at all times just where and when the different maids are working just as well as though she personally visited every corridor of the hotel.

The dictograph plays an important part in saving time in the management of the hotel by enabling impromptu conferences to be held between executive officials at any moment without calling them from their posts. The entertainment of an army of guests requires good tactics on the part of the army of the hotel staff, and the maneuvering is greatly facilitated by the instantaneous and direct intercommunication afforded by the dictograph.

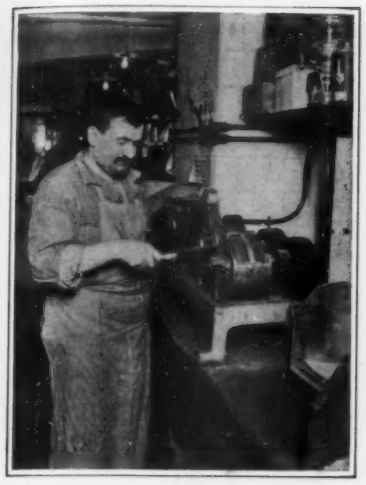
The telephone installation is of course the major means of communication; it may easily equal that of a good-sized central office. The largest private branch exchange in the world is now in use in a great metropolitan hotel; 16 operators' positions, each equipped with telautograph, 2,000 lines and 75 central office trunks, 500,000 local messages per year in addition to many long distance calls and innumerable inside communications.

One of the most modern devices affecting the business of the "front office" of hotels is an index rack which renders possible the rapid and accurate handling of information relating to guests. The ordinary cumbersome index book, which it is absolutely impracticable to use for a very large number of arrivals and departures, is dispensed with and replaced by a rack which exposes to full view at all times, and at a single glance the names and room numbers of all the guests. By the use of manifolded typewritten slips, made out from the loose-leaf register, this information rack is duplicated in several places so that each department, the telephone switchboard, the mail clerks, etc., have at all times a full current record of the movement of guests. An essential feature of this "unit index rack" system is that the names always appear in their correct alphabetical order, without blank spaces. It is a "live" system, the development of which has been found absolutely indispensable to the operation of the great modern hotel.

The information desk, an essential part of the management of the great hotel, is the nerve center of the guests' activities, just as the manager's office is the nerve center of the hotel organization itself. The information operator, seated on a traveling chair in front of her constantly corrected index rack and equipped with telephone and telautograph instruments, is in position to answer any inquiry that may come in, promptly and accurately.

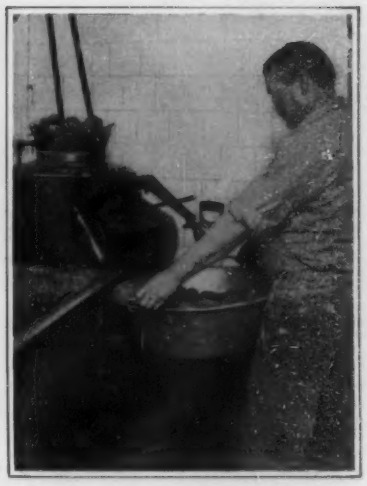
A very large aggregate of labor—sheer muscular effort—is played in the kitchen, general housekeeping and laundry departments by certain mechanical devices. Large electric motor-driven "soup passers" and mayonnaise dressing mixers release the labor of several able-bodied men for other duties and make for cleanness and uniformity of product as well. The soup passer for making *purees* for many hundred guests consists of a large sieve full of soft-boiled vegetables, continually stirred by a pestle; and the mayonnaise dressing mixer

(Concluded on page 420.)

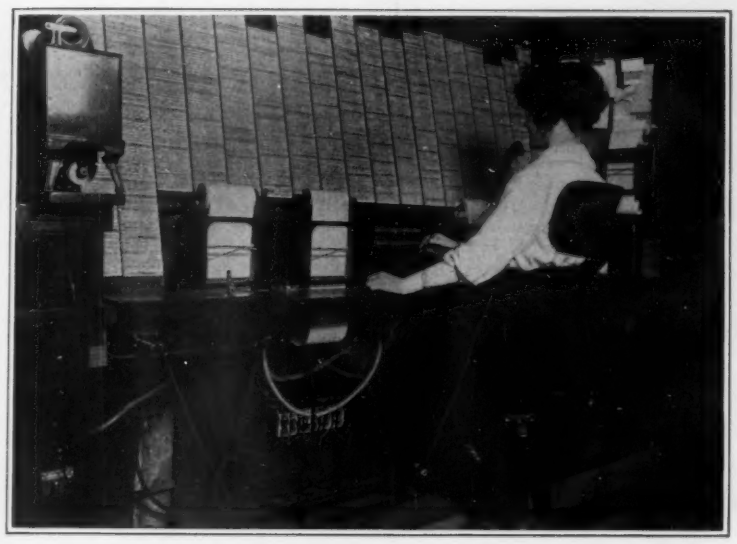


Cleaning knives by machine.

Sawing a block of ice into small cubes.

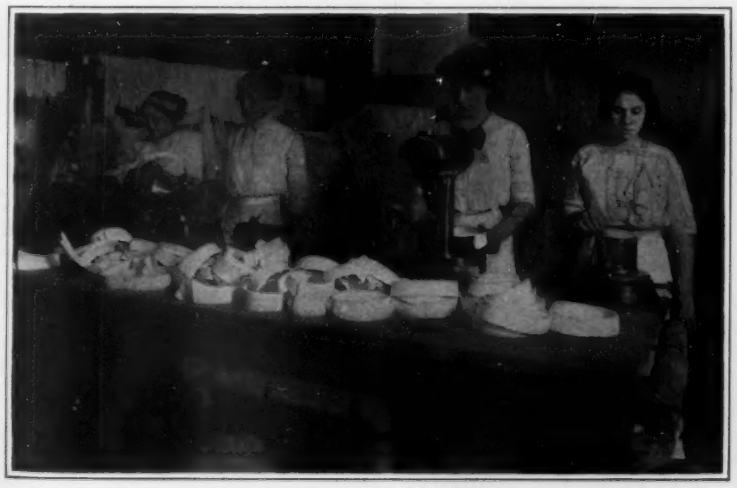


Vegetable paring machine.

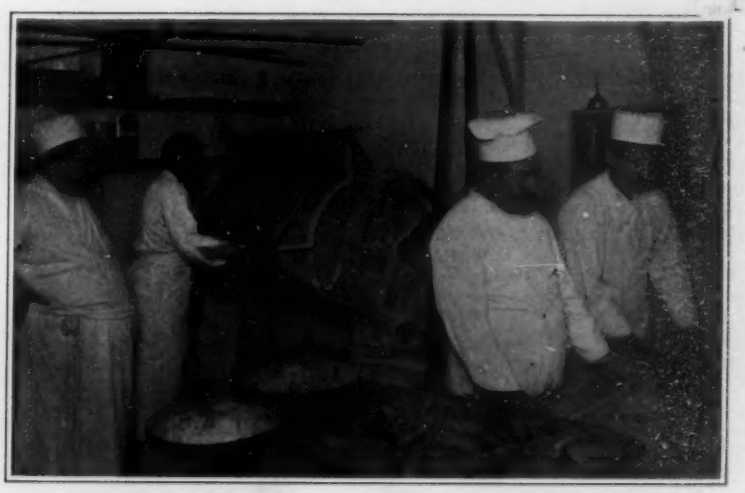


Information operator mounted on a traveling chair.

Churning up a batch of butter.



Showing four stages in the process of ironing a collar.



Making bread, the dough mixer in the background.

A gang of automatically timed egg boilers.

Machine for ironing the bosom, neck-band, cuffs, etc., of a shirt.

LABOR SAVING MACHINERY OF THE MODERN, GREAT HOTEL

The Heavens in December

Return of the Third Comet of 1900

By Henry Norris Russell, Ph.D.

STILL another comet, and again a periodic one, has to be reported this month. It was first seen by Zinner at Bamberg, Germany, on October 23rd, and was visible in a small telescope. At that date it was in the constellation Serpens, a little south of the equator, and set about four hours later than the Sun. As soon as its orbit was calculated it was recognized as a return of the third comet of 1900—the second return since the original discovery, but the first one observed, since in 1907 the comet and the Earth were far apart.

The annexed diagram of the comet's orbit will make this very clear. As usual, the part of the comet's orbit which lies above the plane of the paper, in which the planetary orbits are supposed to lie, is drawn with a full line, and the part which lies below with a dotted line.

The inclination of the orbit is 31 degrees, and the comet's period is 6.46 years. When the comet was in perihelion at C in 1900 the Earth was at E_1, about eighty million miles away; and as the comet and Earth were moving around the Sun in the same direction (the comet a little the faster), the distance between the two never decreased far below this amount. In 1907, when the comet returned to C, the Earth was at E_2, more than 160 million miles away, and on the other side of the Sun, so it is no wonder that this return was not observed. This year, when the comet came once more to C (on November 2nd) the Earth was at E_3, only fifty million miles away, and the conditions for observation were very favorable. In 1920 they will obviously again be very bad, but in 1926, unless the comet's period is changed by the attraction of Jupiter, it should come very near the Earth.

As is the case with all short-period comets, the orbit of this one passes quite near to that of Jupiter. Indeed, at the last aphelion passage of the comet, in 1910, it was pretty near Jupiter for some months, and its orbit may have been a good deal changed.

The comet's apparent motion in the skies took it rapidly southward, so that on November 19th it was already in 30 degrees south declination, and lost to northern observers.

Of the three comets previously under observation, Metcalf's is in Capricornus in 20 hours 53 minutes right ascension and —14 degrees 26 minutes declination on November 30th, and moving 30 seconds west and 18 minutes south per day. It is then only one third as bright as at discovery, and rapidly decreasing in brightness.

Neujmin's comet is now fainter than the fourteenth magnitude, and can be seen only with the largest instruments. Elements of its orbit, calculated at the University of California on the basis of observations covering an interval of six weeks, indicate a period of 17.83 years for this remarkable object; but a longer series of observations will be needed to determine the period with precision.

Westphal's comet, on the other hand, is still well placed for observation in the evening. It is slowly receding from the Earth and Sun, but should be still a conspicuous telescopic object. The published ephemerides of its motion have already run out at the moment of writing, and no later ones have been received; but a direct calculation shows that during December the position should be as follows:

Nov. 29..	R. A.	20h 35m	Declination + 40°
Dec. 15.:	"	20h 51m	" + 48°
Dec. 31..	"	21h 18m	" + 56°

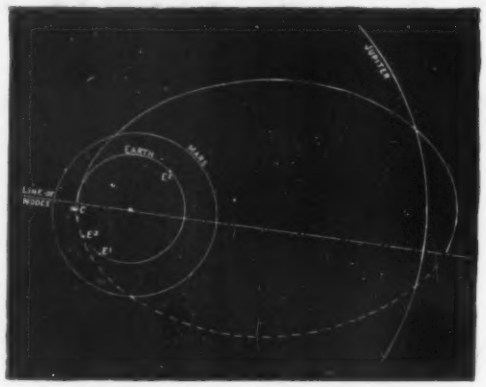
It moves northward and a little westward from Cygnus into Cepheus, passing about 2 degrees west of α Cygni on December 9th. By the end of the month it is a circumpolar object visible all night long, but best in the evening.

Almost nothing has yet been published concerning its appearance or physical characteristics, but it seems to be considerably fainter than in 1852. In that year it reached the magnitude 4.5, and though it is a little farther from the Earth this time it ought, unless it has really faded, to be of the 5th magnitude on December 1st, and easily visible to the naked eye; while last month, when it should theoretically have been as bright as this, it was actually far fainter and not conspicuous in a small telescope. But the brightness of a comet is an unpredictable affair, depending largely upon its own internal activity, and usually increasing at and after its perihelion passage; and this comet may therefore become visible to the naked eye after all.

The Heavens.

Our map shows how the splendid group of winter constellations which centers in Orion has come fully into sight once more.

The whole southeastern quarter of the heavens is full of bright stars. Perseus and Auriga are right overhead, and Taurus is just south of the zenith. Orion and



Orbit of Zinner's comet.

Canis Major are resplendent in the southeast, and Gemini and Canis Minor in the east. Below the latter rises the head of Hydra, and the "sickle" of Leo is in sight farther north.

Between these and Gemini is the inconspicuous group of Cancer, remarkable only for the star-cluster called Præsepe—a hazy patch of light to the naked eye, resolved into separate stars by a field-glass.

The stars of this cluster are moving together in the heavens, very slowly; and recent measures by Schwarzschild at Potsdam show that they are receding from the Earth at the relatively rapid rate of 36 kilometers per second. It seems likely, though not certain, that this cluster of stars is really moving in the same direction and at the same rate as the Hyades group in Taurus, in which case its distance must be a little over 500 light years, and the brighter stars in it must be about equal to Sirius in real luminosity.

In the circumpolar sky we find Ursa Major coming up in the northeast, Draco and Ursa Minor below the Pole, and Cepheus and Cassiopeia on the left. The great square of Pegasus stands on one corner in the western sky, with Andromeda above it, and Aries a little to the left of her. The vast dull expanse of Pisces, Cetus, and Eridanus fills the whole southeastern quarter of the sky.

While the great nebula of Andromeda remains well visible in the western sky, we may well refer to a recent and very remarkable observation by Dr. Slipher of the Lowell Observatory. It is well known that the spectrum of this nebula closely resembles that of the Sun, suggesting that it is really a huge cloud of stars, mainly of the solar type. Slipher, by long exposures with a suitable spectrograph, has obtained photographs of its spectrum, with "comparison lines" serving as standards of reference, which are of such excellence as to permit a determination of the displacement of the lines in the nebular spectrum arising from its motion in the line of sight. Four plates give accordant results, and show that the nebula is approaching us at the enormous rate of 300 kilometers per second—the highest velocity yet met with in such work.

The nucleus of the nebula, which is fairly well defined, shows no sensible proper motion, and unless the nebula is rushing directly toward our system, its distance must be exceedingly great. If such studies can be extended to a few more of the spiral nebulæ we may be able to form a much better idea of the distances, dimensions, and nature of these strange bodies.

The Planets.

Mercury is a morning star all through December, and is best visible about the time of his greatest elongation on the 10th, when he rises about 5:30 A. M. and is well clear of the horizon before dawn.

Venus too is a morning star and is in conjunction with Mercury on the 2nd, being 1½ degrees south of him. The two planets will make a pretty picture in the morning sky.

Mars is in the southern part of Gemini, moving slowly westward among the stars, and growing brighter until his opposition on January 5th. He rises at 7:30 P. M. at the beginning of the month, and 5 P. M. at its close, and is the most conspicuous object in the eastern sky, being almost as bright as Sirius.

Jupiter is evening star in Sagittarius, and is rapidly disappearing into the twilight. He sets about 7:20 P. M. on the 1st, and 5:40 on the 31st, by which time he is practically unobservable.

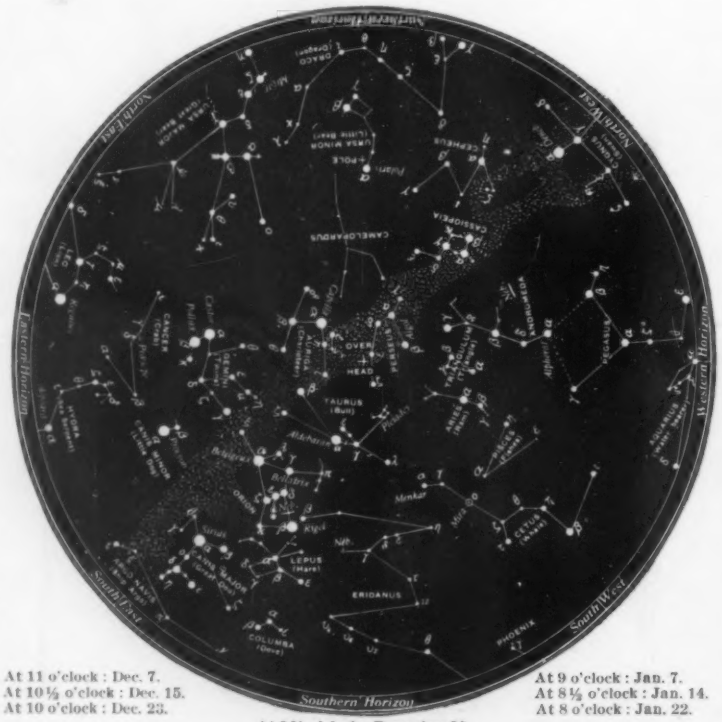
Saturn is in opposition on the 7th, and is visible all night long. He is admirably placed for observation in our latitude, being in Taurus, more than 20 degrees north of the celestial equator. His rings are now opened out almost to the full extent to which we ever see them, and contribute largely to his great apparent brightness (which exceeds that of Capella, and is surpassed only by Sirius and Canopus among the fixed stars). His brightest satellite, Letan, which is easily visible with a three-inch telescope, is west of the planet on December 7th, south of it on the 11th, east on the 15th, north on the 19th, east again on the 23rd, etc.—its period being 16 days. The fainter satellites may be identified by the aid of the diagrams given in the Nautical Almanac.

Uranus is evening star in Capricornus, setting about three hours after the Sun, and hardly observable. Neptune is in Gemini and comes to the meridian about 2 A. M.

The Moon is in her first quarter at 10 A. M. on the 5th, full at 10 A. M. on the 13th, in her last quarter at 11 A. M. on the 20th, and new at 10 A. M. on the 27th. She is nearest us on the 21st, and farthest away on the 6th. During the month she is in conjunction with Uranus on the 2nd, Saturn on the 12th, Mars on the 15th, Neptune on the 16th, Mercury and Venus on the 26th, Jupiter on the 28th, and Uranus again on the 29th.

At 5 A. M. on the 22nd, the Sun reaches his greatest southern declination, and enters the "sign" of Capricorn, and, in the almanac phrase, "Winter commences."

Princeton University Observatory.



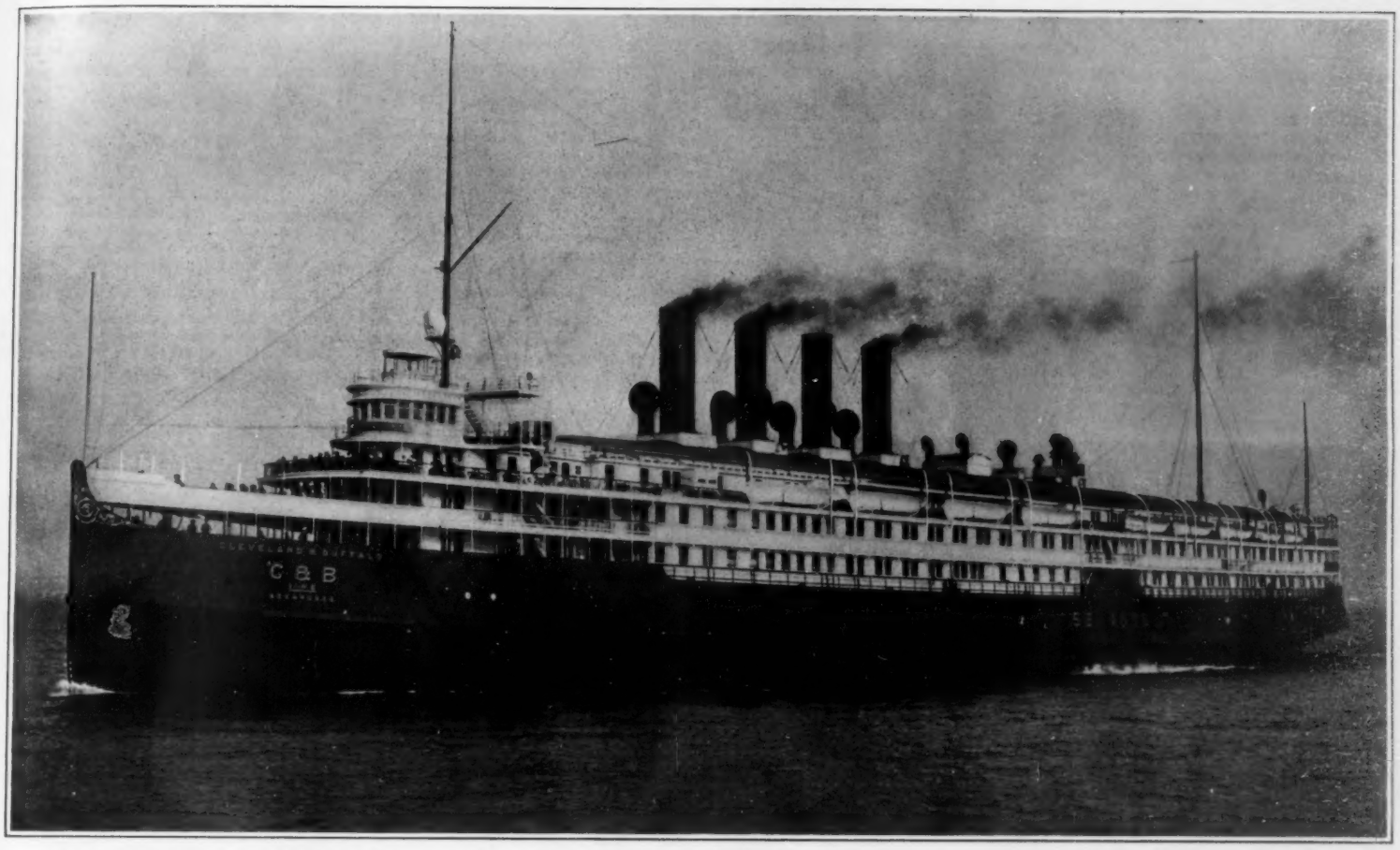
At 11 o'clock: Dec. 7.
At 10½ o'clock: Dec. 15.
At 10 o'clock: Dec. 23.

At 9 o'clock: Jan. 7.
At 8½ o'clock: Jan. 14.
At 8 o'clock: Jan. 22.

At 9½ o'clock: December 30.

NIGHT SKY: DECEMBER AND JANUARY

New Plants in the National Forests.—In the course of an elaborate study by the Forest Service of the grazing resources of the national forests about 9,000 plant specimens have been collected, an examination of which has disclosed 125 new species.



Length over all, 500 feet. Beam: Of hull, 58 feet; over guards, 97.8 feet. Horse-power, 12,000. Speed, 22 miles Sleeping accommodations, 1,500. Carrying capacity, 3,000.

The Lake steamer "Seeandbee," largest side-wheel steamer afloat.

The Greatest Side-wheel Steamer Afloat

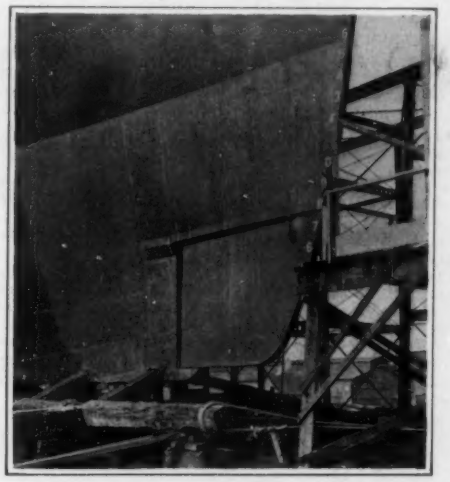
The "Seeandbee," Latest of the Large Lake Passenger Steamers

So great is the interest aroused by the remarkably rapid increase in dimensions of the ocean liners, that the public is apt to overlook the fact that a proportionate growth has been taking place in the size, speed, and luxurious accommodations of those fine vessels which ply upon the inland waters of the United States. It is a fact, however, that the largest steamers of that excellent fleet of ships which serves the various ports on the shores of the Great Lakes, have reached a size which twenty-five years ago was the limit for ocean-going steamers, and beyond which in those days it was considered to be unlikely that the ship owner and ship builder would care to go.

Although the "Seeandbee," which was built for the Buffalo and Cleveland Transit Company of Cleveland, is destined only for lake service, it must be admitted that, with her high freeboard, great length and imposing array of four smokestacks, she has very much of an ocean-going look about her. As a matter of fact, she would be perfectly well able to take her place, so far as seaworthy qualities are concerned, in the transatlantic service. This fine vessel, which was built on the lakes by the Detroit Shipbuilding Company, is 500 feet in length over all, 58 feet beam, 97.8 inches wide over the guards, and her engines of 12,000 horsepower are capable of driving the ship at a speed of 22 miles per hour. The hull is built entirely of steel, with a double bottom three feet in depth extending for 365 feet of her length. The hull above the double bottom is divided by eleven athwartship watertight bulkheads, which extend from the keel to the main deck. With the exception of the collision bulkheads and other bulkheads that are required by law to be without openings, all these bulkheads are fitted with water-tight doors, operated hydraulically from the engine room. Including the tank tops there are seven decks in all.

An excellent feature of the vessel is the fact that the steel construction of the ship is carried up to the promenade deck, and the housings on the orlop and main decks and the top sides to the promenade decks are of steel. The beams and under side of the promenade deck are sheathed with galvanized iron, lined with heavy asbestos paper between the iron and the wood. Fireproof walls extend from the main deck to the dome, dividing the vessel into three separate compartments so far as fire protection is concerned. Furthermore, in addition to these three main divisions, the vessel is divided into fifty sections for fire alarm purposes, and wiring is led from each section to the engine room and captain's cabin, where annunciators give instant notice of an outbreak of fire.

One of the low-pressure cylinders—8 feet diameter. Weight, 38 tons.



The bow rudder, to assist in navigating tortuous channels.

In a recent editorial on the fire on the "Volturno," we drew attention to the value of the automatic sprinkler as a preventive of serious fire aboard ships; and we are pleased to note that in this vessel a complete automatic sprinkler system is fitted throughout the interior of the ship, covering all cargo holds, crew's spaces, hallways, cabins, smoking rooms and other service rooms of the ship. Moreover when the vessel is docked, connections are at once made whereby city protection for fire purposes can be utilized.

To facilitate quick handling of this large vessel in the rivers and harbors, she is furnished with a bow rudder as shown in one of our illustrations. This is controlled by a steam steering engine located on the main deck forward and the after steering rudder is also controlled by a steam steering engine connected to the quadrant by a chain.

The two paddle wheels are each 32 feet 9 inches in diameter. They are driven by a three-cylinder compound inclined engine with one high-pressure cylinder 66 inches in diameter and two low-pressure each 96 inches in diameter, the common stroke being 108 inches. The high-pressure cylinder is located in the center with a low-pressure on either side. The low-pressure cylinders are massive, but very perfect castings, each about 13 feet in length and 13 feet high over the steam chests.

The main shaft is of open hearth hollow forged steel, 26¾ inches in the main bearings, 29¾ inches in the outboard bearings, and 78 feet 6 inches long, with an 11¾-inch hole throughout the entire length. The shaft weighs 120 tons.

Steam is supplied by nine Scotch boilers, with a total grate surface of 590 square feet and a total heating surface of about 27,600 square feet.

Sound and lake steamers have always been remarkable for the extent of their passenger accommodations. The "Seeandbee" has altogether 510 staterooms, including 24 parlors *en suite*, with private bath and toilet, and 62 staterooms with private toilet accommodations. The total sleeping capacity is 1,500 passengers, which is comparable with that of the largest modern hotels.

Aviation in Peru.—An aviation school has been established at Lima, Peru, under the auspices of the National Aero League, and with a subsidy of $27,000 from the Peruvian government for purchasing aeroplanes and equipment.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

GARMENT.—M. LANGMAN, care of M. Lowenstein, 491 Broadway, New York, N. Y. This garment is designed for use by women as a bathing suit, gymnasium suit and the like, and arranged to snugly fit women of different waist measure, to provide the desired comfort, to allow of conveniently donning or removing the suit, and to permit of sanitary use without its removal.

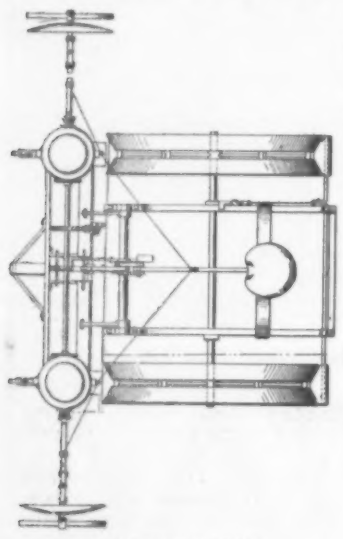
Pertaining to Aviation.

FLYING MACHINE.—W. L. QUICK, care of Mason Furniture Co., Huntsville, Ala. In this machine great strength and lightness are combined with perfect elasticity, and the constituent parts are so arranged as to give automatic stability to the entire apparatus, while at the same time permitting any manual adjustment which may be required.

Of Interest to Farmers.

FRUIT GRADING APPARATUS.—R. H. PEACOCK, Berlin, N. J. In the present patent the invention has reference to apparatus for grading fruit, and particularly fruits of a certain class, such as oranges, the quality of which is determined by the amount of juice which the fruit contains.

CHECK ROW PLANTER.—R. I. FOREMAN, care of Fox River Academy, Sheridan, Ill. Mr. Foreman's invention is an improvement in check row planters, and has for its object the

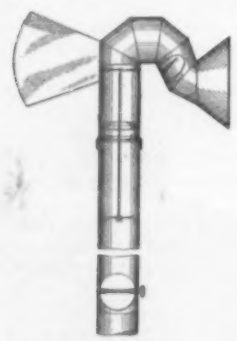


CHECK ROW PLANTER.

provision of simple, easily operated means for tripping the seed valves to cause the planter to drop a charge of seed at regular predetermined intervals without the use of knotted wire, the said means being operated by the movement of th machine through the field.

Of General Interest.

REVOLVING VENTILATOR.—O. W. SEARCY, care of Chas. S. Banks, Box 774, Manila, P. I. This ventilator is adapted to be employed aboard ships, or in connection with residences



REVOLVING VENTILATOR.

or other buildings, and more particularly the invention has reference to ventilators comprising a down-pipe and a funnel at the upper end to constitute the air intake. The funnel is mounted to turn, and is balanced and automatically maintained toward the wind by means of a vane. It revolves readily to a change of wind direction and prevents rain or snow from being blown or carried into the down-pipe.

SANITARY SAND BLAST HELMET.—W. DUNCAN and J. A. SPANGLER, 909 McDonald St., Attica, Ind. The invention relates particularly to a helmet for use in foundries to protect workmen without interfering with their view of the work, which besides being light and neat in appearance will permit the proper supply of air to the workman without causing a suction of dust into the helmet.

HORSESHOE CALK.—W. I. MILLER and J. W. MILLER, Red Wing, Minn. In this instance the invention has reference to improvements in horseshoe calks, and has for an object the provision of an improved toe calk designed to be easily applied and removed, while presenting all of the advantages of a perfectly solid construction.

REINFORCED CONCRETE POLE.—H. S. STOUT, Huntington, W. Va. This invention refers to reinforced concrete poles, and more particularly to the class comprising a metallic body covered with concrete. An object is to provide an inexpensive pole having a high coefficiency of resistance to bending stresses, and sufficient resiliency to withstand shocks and to form a pole of uniform strength.

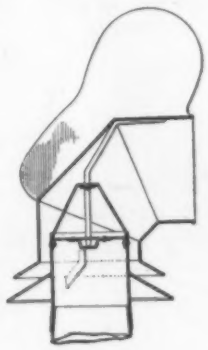
WELL CLEANING DEVICE.—J. F. KILBURN, care of George E. Wallace, 416 Caples Bldg., El Paso, Tex. The invention has particular reference to means or appliances for such wells which are adapted to insure perfect and satisfactory operation of wells of any depth which may be dug or drilled in the vicinity of quicksand or other sedimentary matter which so frequently clogs up the working barrel and causes stoppage of the pump.

PLUMBERS' KIT.—F. AUTY, 356 W. 24th St., Whitestone, N. Y., N. Y. The invention provides a kit serving under certain conditions as a furnace or support for the metal pot, and under other conditions as a carrier or container for the tools and equipment ordinarily used by a plumber, enabling him to carry his complete outfit conveniently and in but one hand.

METHOD OF MAKING SIGNS.—N. A. RACHLISS, care of Mr. Lak, 314 Kirby St., Detroit, Mich. The object here is to produce sign letters and the like on signboards, from plastic material, such as plaster of Paris, molten or fused metals, alloys, amalgams, fictile or other materials, that become hard and set from a condition of plasticity or fluidity.

STUFFING BOX AND BEARING FOR SHAFTS OF MARINE PROPELLERS.—H. D. BACON, care of Bath Marine Construction Co., Bath, Maine. The chief object here is to provide a shaft stuffing-box and bearing that offers minimum friction to the water as the boat or other craft is propelled through it, and will readily adapt itself to any angular shifting or displacement of the shaft relative to the keel.

VENTILATOR.—J. K. ROBINSON, 406 Louisiana St., Little Rock, Ark. In this case the invention comprehends a ventilator provided with a stationary draft member such as a pipe, flue or chimney, and a cowl journaled upon said member and provided with means for shifting the cowl under control of the wind



VENTILATOR.

into different angular positions, the cowl being provided with means for facilitating the travel of air through the draft member, thus forcing a draft within the latter. It is for use in attics, rooms, halls and other parts of an edifice and may be employed in connection with the discharge of smoke, gases and vapors from buildings and analogous structures. The owners' factory is now running for its manufacture with a capacity of 500 per day.

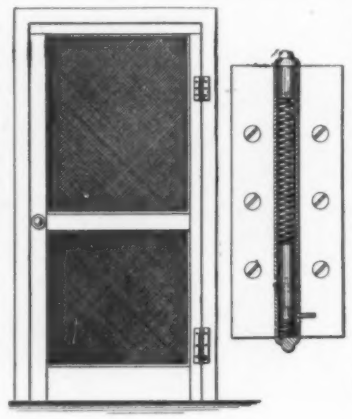
WATERPROOF COMPOSITION.—NATALE FORNI, 610 Wilson St., Santa Rosa, Cal. The primary object of Mr. Forni's invention is to produce a waterproof mixture of about the consistency of milk which is adapted and intended to be mixed with cement and sharp, clean sand in proper proportions and will form a product absolutely impervious to water. In carrying out the invention and producing the mixture, he mixes burnt stone lime and crude linseed oil in the proportions of one hundred pounds of the former to seventy pounds of the latter, and sufficient water to slake the lime together with twenty-five pounds of sulphur. The oil is added to the lime very slowly and carefully during the slaking of the lime, so as not to interrupt this chemical operation. The mixture thus produced is kept in suitable receptacles ready for use by mixing it with cement and sharp sand, by which means an entirely waterproof product is formed. The composition consists of burnt lime one hundred parts; crude linseed oil, seventy parts; and water in due proportion to effect slaking of the lime together with sulphur, twenty-five parts.

Hardware and Tools.

LOCK.—A. M. HOES, 404 E. 6th St., Grand Island, Neb. The primary object here is to provide a lock which is an improvement on the prior patent No. 966,208, granted to Mr. Hoes. In addition to the objects there stated the present invention aims to provide a less complicated lock, one easier to make from cast or malleable iron, and a lock the actuating elements of which shall have ample leverage to enable a child to operate the same.

DENTAL INSTRUMENT.—F. T. WALLEN, Bismarck, Mo. The principal object of the invention is to provide a dental instrument adapted to be positioned between the upper and lower processes in order to obtain the length of bite when the lips are together, whereby the fitting of teeth may be proper.

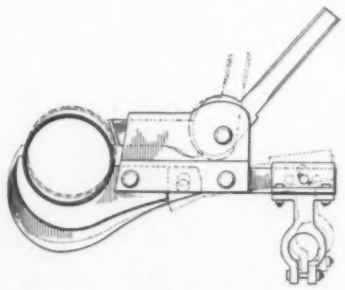
SPRING HINGE.—M. FURUYA, 571 W. 159th St., New York, N. Y. This inventor provides a hinge with a pair of pivotally connected levers, and a spring structure acting on the leaves normally for maintaining the same in a cer-



SPRING HINGE.

tain position, the hinge and spring having associated therewith a lock for locking the spring against operating in one direction when the leaves have been opened to a certain extent in order to allow the leaves to move back and forth pivotally freely within certain limits.

WRENCH FOR ROTARY WELL DRILLS.—G. F. LEBUS, Electra, Tex. The wrench is particularly adapted for unscrewing the coupling which attaches a drill point to a pipe section, and also for detaching pipe sections from each other. It grips the coupling tightly, but releases from it easily, a merit not generally possessed by wrenches of this class. It is



WRENCH FOR ROTARY WELL DRILLS.

adapted for various vertical and horizontal adjustments, which facilitate its attachment to a screw pipe coupling so as to economize time and labor. It is adapted for convenient detachment of its tooth and slidable lug or jaw when worn and the substitution of a new one therefor.

Heating and Lighting.

LAMP BURNER.—LEWIS P. MOORE, Weldon, Ill. The purpose here is to provide a burner with horizontal tubes for collecting air from between the crown member of the burner and the chimney, and directing the air to within the said crown member, wings extending below and above the horizontal tubes at each side of the wick tube, for directing the air from the horizontal tubes to the wick.

CIGAR LIGHTER.—O. G. KLUGEL, 204 Indiana Ave., Indianapolis, Ind. The gas flame may be suspended in convenient position for use, the lighter being for convenient use by persons of different heights. At a state of rest the lighter will burn a small or pilot flame, but when operated by a swinging lever under spring tension, will cause the flow of an increased volume of gas to produce a larger flame or blast which will require but a very minute time to light a cigar or the like.

Household Utilities.

VALVE FLOAT FOR CLOSET TANKS.—C. M. BRENNER, 219 Texas St., Shreveport, La. This inventor provides a float which will have not only the permanent air chamber common to devices of this character, but in addition have a water-sealed air pocket. He disposes a bell-shaped member within a substantially semi-spherical member, fastening them together to form between the members a permanent air-chamber, the open end of both members normally facing downward to be closed by the water rising in the tank, to form an additional air pocket.

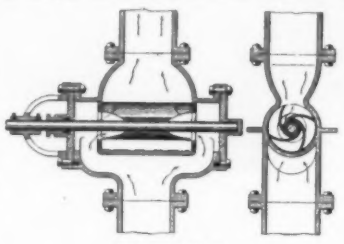
Machines and Mechanical Devices.

CONVEYOR FOR BOTTLED SODA WATER.—E. R. BARBER, 105 Ashley St., Valdosta, Ga. It is the design of this invention to provide a means for conveying soda water in bottles, in bottling works, from the different tables or from automatic bottling machines, to any point in the plant where the goods are to be examined, labeled and packed, ready for shipment or for sale.

SPRING HAMMER.—R. R. SMITH, 701 W. Main St., Oklahoma, Okla. The present invention is directed to an improved means of varying the pressure on the hammer element by compressing or relaxing the spring, the said means being carried on the outside of the casing, and the relation of the said means to the casing affording an indication of the pressure on the said spring.

CEMENT TILE MAKING MACHINE.—E. B. TURNER, Bird City, Kan. An object here is to provide a device by means of which sub-irrigation tile may be made in the ditch in which it is to be laid. Another object is to provide a device for making tile which insures the production of a uniform grade of well-packed concrete tile.

ROTARY PUMP.—BENJAMIN F. CATHCART, 702 K St., Fresno, Cal. The invention relates to improvements in rotary pumps, and has reference more particularly to the class comprising a stator having an inlet and an outlet, and a rotor within the stator, between the inlet and the outlet, having a plurality of blades and flanged heads integral with the ends of



ROTARY PUMP.

the blades, and an opening in the heads establishing communication between the inlet and the outlet of the rotor. An object of the invention is to provide an inexpensive, simple and efficient rotary pump in which the pressure necessary for raising the water is obtained by providing inlets in the rotor of a reduced diameter, lying between the inlet and the outlet of the stator.

PUMP.—H. MEAD, care of H. P. Jayne, care of Coalinga Chamber of Commerce, Coalinga, Cal. This improvement refers to oil pumps, and it has for its object to provide one which will hold in suspension uniformly, from the bottom to the top of the well, the sand which becomes mixed with the oil or substance which is being pumped.

Railways and Their Accessories.

RAILWAY SPLICE.—C. M. MILLER, Tyrone, Pa. This inventor devises a means for splicing railway rails of a simple and reliable character, the same providing for the utmost simplicity and facility in making the application of the track and also providing for easy renewal or replacement of one rail without disturbing the other.

RAIL TIE AND ANCHOR.—F. H. STANFORD, care of Stanford Metal R. R. Tie Co., 1195 E. Broad St., Elizabeth, N. J. The invention devises a metallic cross-tie adapted for the support of a novel form of rail securing devices. It produces a combined rail brace and anchor whereby the rail will be supported so as to resist all sliding and tilting movements by simple and reliable construction.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Central Station Power for Farmers

(Concluded from page 405.)

on the average power rate of five cents a kilowatt hour and include interest on the investment charged at 6 per cent, depreciation of the machinery at 10 per cent, and labor hire when necessary at 15 cents an hour.

Operation.	Capacity of machine, per hour.	Horse-power of motor required.	Kilowatt hours required.	Operating cost.
Crushing Oats	111 bushels	10	0.062 per bushel	$0.0068 per bushel
Shelling Corn (cylinder sheller)	114 bushels	10	0.0448 per bushel	0.0137 per bushel
Cutting Fodder	1½ tons	15	2.04 per ton	0.307 per ton
Grinding Ear Corn	40 bushels	15	0.411 per bushel	0.04 per bushel
Grinding Shelled Corn (fine)	41.5 bushels	15	0.272 per bushel	0.0248 per bushel
Cracked Shelled Corn	65 bushels	10	0.086 per bushel	0.0137 per bushel
Six-roll Shredder and Husker	1.95 tons	15	5.37 per ton	2.85 per ton
Root Cutter	5.78 tons	2	0.158 per ton	0.1198 per ton
Threshing Barley*	145 bushels	20	0.1257 per bushel	0.0064 per bushel
Churning, Working and Washing Butter	100 gallons	2	0.617 per cwt.	0.244 per cwt.
Separating Milk	1,300 pounds	1½	0.0386 per cwt.	0.0284 per cwt.
Grinding Sausage	750 pounds	2½	0.441 per cwt.	0.1 per cwt.
Sausage Stuffer	116 pounds	½	0.0525 per cwt.	0.3766 per cwt.
Washing Machine (12 sheets per washerful)	3 washerfuls	½	0.0616 per washerful	0.0454 per washerful
Portable Vacuum Cleaner	1,000 square feet	¾	0.0226 per 100 sq. ft.	0.0207 per 100 sq. ft.
Horse Groomer	7 horses	1	0.106 per horse	0.053 per horse

* Power charge only.

We must remember that these costs cover both the price of the hired man and his keep. Though it will be discovered that some of the machines in the tests are of large capacity, it was discovered in checking by tests of smaller machines of the same kind that the variation in unit cost—that is per bushel or ton—was very slight, if any.

It is needless for me to enumerate the many advantages accrued by using electric power, as they are well known to most of us. However, there is one advantage which the farmer appreciates more than any one else, and that is the saving in time and labor. The labor problem on the farm to-day is almost as vital as the maintenance of the fertility of the soil, and every labor-saving device is greeted with open arms by the farmer.

Although this new field for electricity is yet in its infancy, the time is not far distant when every well-populated farming district will have its transmission lines, for the distribution of electricity for light and power.

Meteorological Stations in Venezuela

THE Venezuelan government has decreed the establishment of meteorological stations at Merida, Ciudad Bolivar, Maracaibo, and Calabozo. This is noteworthy for the reason that aside from the Observatorio Cagigal at Caracas there are, at present, no regular meteorological stations in Venezuela, which is, climatologically, one of the least known countries in the world.

Patents for Cereal Coffee or Coffee Substitutes.—John H. Kellogg of Battle Creek, Mich., has secured four patents, Nos. 1,069,265 to 1,069,268, inclusive, for cereal coffee or coffee substitute, some of which develop the idea of extracting the liquor from boiled cereal coffee and mixing with the extract, cereal to form a coating upon the surfaces of the cereal coffee.

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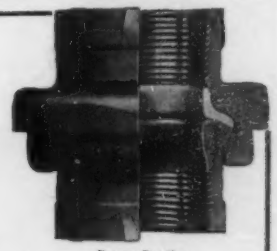

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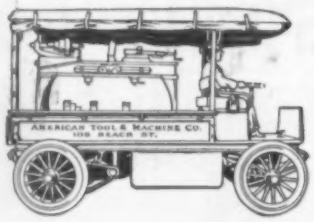

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The Motor-driven Commercial Vehicle

This department is devoted to the interests of present and prospective owners of motor trucks and delivery wagons. The Editor will endeavor to answer any questions relating to mechanical features, operation and management of commercial motor vehicles.

Mechanical Loaders for Motor Trucks

Editor of Motor Truck Department:

In view of the tremendous interest in sand-and-clay roads now in North Carolina, and doubtless throughout the South Atlantic States, I write to ask if there is any effectual sand dumping truck—motor truck—which is also supplied with an appliance to *load* it with something like the same facility with which it may be unloaded. I have been in correspondence with a company which sends me a description of a dumping motor truck, but, so far as I am advised, there is no machine which can load itself with the same power that runs it nor is there any separate companion machine to do this work. On the contrary, even the sand dumping machine that is described to me, which gets clear of its load so easily, must be loaded by the clumsy and expensive method of shoveling it in by hand of day laborers.

In the construction of railroads now and digging of canals they have machines which load flat cars with dirt and *débris* almost as quickly as they are unloaded. It seems to me that a machine may be devised on the same principle, but of somewhat different construction, which would scoop up the sand with such facility as to make the loading of the truck a matter of small expense and time.

If such a machine is put on the market and properly demonstrated in the places where it is needed, as for example in forty counties in North Carolina, there is practically no end to the amount of business that might be done by the enterprising company which put them on the market. There is now an unexampled wave of interest in road building, and this interest is centered in the sand-and-clay road of eastern and central North Carolina, and similarly located sections in other States on the South Atlantic and Gulf. Experiments are being conducted in almost every county and sand-and-clay roads are claimed by many experts to be the best for all purposes. W. J. PEELE.

Raleigh, N. C.

[A machine such as this was described in the SCIENTIFIC AMERICAN of July 26th, 1913.—EDITOR.]

Determining Coasting Ability of Electric Commercial Vehicles

IT is a fairly well established fact that the operators of electric commercial vehicles are prone to run with the power on a good part of the time when the momentum of the vehicle would carry it a considerable distance without power, thus effecting a material saving in current consumption. That this fact is recognized in railroad work is emphasized by the action of the engineers of the Hudson tubes between New York city and New Jersey, where meters have been fitted to the cars to ascertain exactly the ratio between the time run under power and the time run without power. Motormen are encouraged to coast as much as possible without upsetting their running schedules by the offer of bonuses for records of coasting in excess of a standard set by the engineers, and it is understood that the method has resulted in a material saving in operating expense. By way of applying the same principle of economy to electric commercial vehicles a prominent New York firm recently has placed upon the market a device designed to show accurately the number of vehicle miles with the power on and the number of miles with the power off. The device itself is extremely simple; it consists of nothing more complicated than an ordinary odometer operated in the usual manner from one of the front wheels of the vehicle. Instead of a single row of registering figures, however, the meter has two rows; one row records the total number of miles covered by the vehicle and the other row registers only the number of miles covered with the current turned off—the number of miles coasted, in other words. As a concrete example of the operation of the device, it is pointed out by the makers that a 3½-ton electric truck driven over a predetermined route in New York city without serious attempt on the part of the driver to coast showed a coasting percentage of 20. When the same vehicle was driven over the same route and the advantage of every opportunity to coast was taken, it was found that the coasting percentage had been increased by 10. At the same time, readings taken with an integrating wattmeter disclosed that the saving in consumption of the second run over the first run was exactly 11.1 per cent despite the fact that the average speed of the two runs was approximately the same.

Vaporizing Kerosene by Partial Combustion

THE use of kerosene as fuel in an internal combustion motor of the motor vehicle type presents difficulties so many and so serious that though for years innumerable efforts have been made to overcome them, very little of real practical value was accomplished until the necessary stimulus was furnished by the abnormal increase in the price of gasoline. It may be remarked that carbureters for feeding kerosene to motors running at practically constant speed are comparatively easy to produce, and there are not a few that are capable of giving satisfactory results; but it is a much more difficult problem to supply a proper mixture at all times to a motor that jumps in a few seconds from minimum to maximum speed and power, and as quickly jumps back, and must run smoothly and sweetly at any intermediate speed.

The majority of those who have attacked the kerosene carbureter problem have belonged to two broad classes. One has worked along the general lines already well established for the construction of gasoline carbureters, though varying the details somewhat and—what is the chief consideration—adding considerable heat from the exhaust gases to further vaporization. The other class has worked to some extent along gas-producer lines, subjecting kerosene, after vaporization in a carbureter akin to a gasoline carbureter, to a high temperature and so producing a gas differing very considerably from the vapor formed in a carbureter of the conventional type.

Both these forms of apparatus are open to the objection that they depend upon external heat for their operation; therefore the motor must be started first on gasoline and run on gasoline until sufficiently heated to permit the turning on of the heavier fuel. This entails a complete gasoline outfit in addition to the kerosene apparatus. In the carbureter type the vapor produced is easily condensed by contact with cold surfaces, and it is not always an easy matter to avoid smoke, smell and sooty deposit in the cylinders. In the producer type the regulation of heat presents a rather nice problem, for while too low a temperature will produce a raw mixture that will not burn clean in the cylinders, too high a temperature will cause "cracking" and the result will be at least as unsatisfactory. Still, excellent results are obtained when conditions are reasonably favorable, though the producer type is not considered sufficiently flexible for automobile work.

In view of the foregoing some experimental work that just has been brought to a conclusion is of considerable interest. The lines followed differed considerably from those that are more conventional, and the results obtained also are out of

the ordinary. Briefly, the idea was to atomize kerosene with a small volume of air and pass the mixture through a chamber into which projects a spark plug in active operation; a wire gauze screen, or its equivalent, protects the only outlet from the chamber, which is piped to the intake of the motor. Part of the kerosene is ignited by the spark plug and a constant flame is maintained in the stream of vapor drawn through the chamber by the suction of the engine. The screen prevents the passage of the flame from the vicinity of the plug. Approximately one per cent of the kerosene is consumed in maintaining the flame; the oil is not actually gasified, and is not at all hot when mixed with a proper volume of air for complete combustion. It has some decidedly curious properties.

The vapor emerging from the outlet (air pressure is employed in place of suction for demonstration purposes) is white and dense, like thick smoke or steam; it is slightly warm and will not condense on the hand. It floats about in the air with persistence. Finely atomized oil condenses instantly on the hand and does not remain in the air for any appreciable time. Ignited with a match at a little distance from the pipe, the vapor burns with a quick puff and leaves no smoke or smell of burning. Atomized kerosene under the same conditions makes a dense smoke and leaves black particles floating in the air. A wide-mouthed quart bottle filled with vapor stood open for fifteen minutes, actual time, before the vapor became difficult to see; the bottle was cold when filled. The bottle was filled with vapor, the mouth partly closed, a small amount of air admitted and a match applied, when the mixture burned with a slight puff, leaving the bottle perfectly clean and making no smoke or smell. Repeating this experiment about ten times failed to cause any deposit in the bottle, though obviously the mixture was far from correct for complete combustion.

As it is difficult to condense the vapor, even on cold surfaces, and as it seems to burn clean when even gasoline vapor would smoke, it would appear well suited to burning in a motor, and experiments with a number of motors in automobiles of different types and sizes have been made with parallel results. A gasoline motor with a carbureter of this type will start, when perfectly cold, at least as easily as on gasoline. The only way in which it is possible to cause smoke or smell from the fuel is to temporarily extinguish the carbureter flame and permit raw atomized kerosene to pass to the engine, when the familiar black smoke will be emitted. With the carbureter functioning normally the exhaust is sufficiently clean so that a handkerchief held close to the exhaust pipe will not be marked, unless by lubricating oil. Misfiring will cause the unburned charge to be passed out through the exhaust, whence it will emerge as a clean white vapor which floats in the air for a time before becoming dissipated. Combustion in the motor apparently is slightly less rapid than that of gasoline; the motor runs more smoothly and can be throttled to a slower speed and holds its power better when throttled. In the tests so far made the average power has been above that of gasoline in the same motors. Carburetion is not affected by sudden changes of speed. The mileage per gallon has been much higher than with gasoline, in some cases more than double.

Motor Truck Queries and Answers

L. M. O. writes: "I am a merchant in this city of 90,000 inhabitants, but in addition to my local business my deliveries cover a section within a radius of 15 miles. I use 40 horses and 25 wagons in my business, but have decided to replace these entirely with motor trucks within the next year. I have figured that five 2,000-pound trucks and two 2-ton trucks will do this work—and even allow for expansion—but I would like to know if you would advise keeping this equipment in the local garages and have the machines cared for by outside help. Or do you think it better to employ expert repair men and an inspector of my own?"

A. We have had occasion to answer questions of this nature several times, and careful investigation has led us to the opinion that every motor truck installation of the size of the one that you contemplate warrants the services of a private staff of repair men and the erection of a private garage. It is probable that several of your trucks—if not all—will be of the same make, and it would therefore be well for you to engage the services of an expert from that factory as inspector or chief repair man. If you employ men as drivers who are intelligent and careful, it is possible that this one factory expert and an assistant can attend to all of the necessary repairs, replacements, and inspections, leaving the washing and cleaning to the services of a man who would not naturally receive as high wages. In addition to the daily inspections—with which are included fuel, oil and water replenishments—you should arrange to have each vehicle overhauled thoroughly at the end of every six or eight thousand miles. This will keep your fleet in perfect condition, and yet is work that can be accomplished without overtaxing the facilities of your repair organization. The work will be better done than would be the case were the cars left to the tender mercies of the public garage, for your men will learn the peculiar requirements and adjustments of each truck, and the saving in expense will be considerable. If you go about the installation of your motor service in the manner that you indicate, we feel certain that it will prove to be an unqualified success. The erection of a private garage has been found to be economical whenever more than three trucks are to be used by the same concern. We would urge this one point, however: When building your garage, plan for the accommodation of double your intended purchase of trucks, for you will find your installation so efficient and profitable that your business will increase to the point where the extra fleet will soon be required.

P. L. M. writes: "I have a dairy business in which I now use six horses and wagons for the retail deliveries. In order to improve the service in one of the districts covered by three of these wagons, I want to put on a truck. I expect to drive this myself, and would like to know if you think a gasoline truck would prove economical. I drive in seven miles before I make my first deliveries, and the stops average about ten to a block."

A. The retail milk business is one of the very few fields in which the gasoline truck does not always prove an unqualified success. The frequency of the stops permits only a short distance to be covered by each vehicle, and the truck is not therefore given an opportunity to be operated to its full ability. Furthermore, the average driver will leave the motor running during the minute or so required for each delivery, and this may total more than the time during which the car is in operation. This will naturally result in a waste of fuel and oil and will seriously interfere with the maximum efficiency that can be obtained from the truck. Your case is somewhat different, however, you will run seven miles before you will have occasion to stop for a delivery, and the fact that you are to drive the truck yourself and will therefore be careful to avoid the unnecessary use of gasoline and oil may render the purchase of a gasoline truck a most profitable investment. We would suggest one of the thousand pound vehicles with a covered body. With such a truck, you could easily cover the distance from your dairy to your nearest customer in less than half an hour, and the number of deliveries made in a given time could be greatly increased. There is a large field for the use of motor trucks in businesses such as yours, and we feel that your belief in their efficiency is more than warranted.

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Electric Trucks Give Long Service

RELIABILITY is the keynote of Electric Vehicle design and construction. Note these facts: There are several Electric Trucks of 1899 model still running. F. A. Poth & Sons Brewery, in Philadelphia, is using daily an Electric Truck delivered 11 years ago.

Several of the Electric Trucks operated by the New York Edison Company have been in use 10 years. An Electric has been used by Frederick Loeser & Co., Brooklyn, for 11 years; another by Stern Brothers, of New York City, for 9 years. Three of the Electric Vehicle fleet of Tiffany & Co. were delivered early in 1901.

Three of the Electric Trucks owned by Arnold, Constable & Co., New York City, were purchased in 1903, and an Electric built for B. Altman & Co., in 1898, is regularly used.

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What Is Old Age?

(Concluded from page 409.)

the medium on the cells, was that the medium may not only change the dynamic possibilities of tissue, *but that the character of the change may be regulated by a carefully considered modification of the medium.*

The question of the influence of the cells on the medium was taken up in turn, although it has not, as yet, been studied in great detail.

This involves the theory that the cells, in the course of their activity, make such demands upon the nutrition supplied by the medium as to deplete it; and that they thus become the indirect means of introducing into the life process, a chemically destructive agent (catabolism). The result is a gradual slowing down of cell-growth; in other words, progressive ageing of the tissues—and death!

An analogous course was followed in early artificial cultivation. The tissues lived their normal span of life—i. e., a few days—and then died. But it was found that the process of degeneration could be obviated by the procedure which has been already spoken of as insuring "permanent life." In other words, death—for experimental purposes along these lines—has been overcome. Tissues growing *in vitro* for nearly a year and a half, now continue to multiply faster than those of the embryo. Time, for tissues under these circumstances, simply does not exist.

The burning question is; can this or anything approaching it, be done—ultimately—to solve the same question in the body?

Labor-saving Appliances in Hotels

(Concluded from page 412.)

is a first cousin to same, without the sieve bottom, of course. Knife-cleaning and silver-polishing machines, dough mixing and cutting machines, power-driven, are familiar. The dishwashing machine is perhaps the most extensively used power equipment on account of the large volume of work which it handles; since the serving of every order of food means dirty dishes. The dishwashing machine of whatever type operates by bringing the dishes into contact with a mass of hot water containing a strong cleansing compound and afterwards rinsing them in clear hot water; and some machines add a finishing touch by sterilizing the dishes in live steam. A typical machine handles the dishes in baskets, swirling the hot cleansing water around and among them, the rinsing leaving them so clean and hot that they are ready for service without drying with a cloth. The best results with any of these machines are obtained by team work, the helpers giving special attention to greasy and "eggy" dishes as they fill the baskets. Although the work of machines compares favorably with that of ignorant and uncleanly hand workers, a deplorable shortcoming in the use of these machines in many places is that the washing and rinsing waters are not changed often enough. A law has just been passed by the New York State Legislature and signed by Governor Sulzer prohibiting under penalty as a misdemeanor the use of dishes which have not been previously cleansed in a sanitary manner, and prohibiting the use in such cleansing of water which has become unsanitary by previous use.[1]

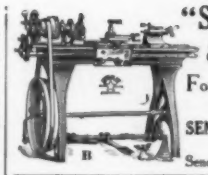
Floor scrubbers and polishers, motor driven, are coming into use to replace the drudgery of human labor on cement and marble or mossaic floors and on hardwood floors respectively. Vacuum cleaning is usually done two or three times a week. Laundry machinery includes large mangles for "flat work," manned by a crew of six or eight men, a number of special devices for nursing collars, shirts and cuffs into shape in imitation of the best hand work, but with a far larger output than would be possible without a prohibitively large force of workers. In one great New York hotel employing about 125 persons in the laundry department, from 61,000 to 63,000 pieces of laundry are handled every day, the guests' laundry amounting to a cash value of $100 to $300 a day. By means of the elaborate equipment of special devices employed—an expensive plant, warranted by the conditions obtaining in a hotel of enormous size—a guest can have his laundry done up and delivered within three hours.

The saving of materials by mechanical devices is closely interlocked with the cleanliness and uniform good service also attained by their use. The handling of ice, manufactured in the hotel's own refrigerating plant, is an example. The cold brine from the refrigerating machine serves directly to "keep" the large tubs of ice cream, thus saving the crushing and handling of ice for this purpose. The product of cake ice is cut into cubes by a gang saw machine and shaved by another machine, respectively for serving iced water and chilled fruits, etc., at the tables. Drinking water for guests' rooms is however served in vacuum bottles filled with the cooled drinking water from piping throughout the hotel. This dispenses very satisfactorily with the formerly inevitable "ice water pitcher," with its clinking contents of dubious ice. A number of food dispensing appliances, primarily designed to give satisfaction to guests by serving a uniform quantity and quality, also prevent waste which would otherwise be very considerable in the aggregate. One of these devices is a butter cutting machine, consisting of a receptacle for the mass of butter with a plunger which extrudes the butter through a row of small gates each the size of the individual pat of butter served to guests at the table. At the right moment a wire is pulled down, cutting off the whole row of pats. A simpler device accomplishes the same result in a somewhat more pleasing manner: a hand implement for scraping off "butter balls" from the top of a tub of butter, a single quick movement rolling up a little scroll, like a golden rosebud, into the hand of the worker. A cream dispensing receptacle delivers just enough cream for one cup of coffee or for a pot of same by a single turn of a faucet which closes automatically when the required amount has been delivered. This appliance saves a few seconds of time; but its principal value is in preventing waste by running over in the rush and hurry of the waiter's work. The French salad dressing dispenser works on the same principle, but has the additional feature of a stirring device which keeps the oil and vinegar well mixed in the receptacle so as to insure uniformity in the portions dispensed. Guests ordering fresh-made tea of some particular brand or blend are insured satisfaction by a tea dispensing receptacle delivering an exact modicum of tea leaves by pulling down a lever. A pancake batter dispenser for use at the griddle enables an inexperienced boy to produce pancakes of uniform size and thickness.

The Current Supplement

IN this week's issue of the SCIENTIFIC AMERICAN SUPPLEMENT Raymond F. Nailler writes on the art of enameling steel and iron.—In an article entitled "The Modern Car and the Noise Problem," Lewis Kingsley tells us of "little refinements that make for silent running."—The adjustment of local time in a large country like ours is a problem of some little difficulty. How it has been solved and how a compromise is struck between theoretical requirements and the exigencies of practical conditions is explained by Harlan T. Stetson in an article accompanied by charts and illustrations.—Harold J. Shepstone tells us some interesting facts about the bat, the only mammal equipped by nature for flight.—The strategic position of Switzerland is altogether peculiar among European countries, and the movements of the Swiss army call for most remarkable performances on the part of the soldiers. One of the articles in our current SUPPLEMENT describes a very wonderful feat, the march of a line three miles long of roped soldiers through glacier country.—A 100 horse-power Junkers marine engine is described and illustrated, and an account is given of some tests performed upon it.—Charles F. Mabery discusses lubrication with oils and colloidal graphite.

[1] This new law is Article 17-a, an amendment to Chapter 49 of the Laws of 1909, to go into effect September 1st, 1913.



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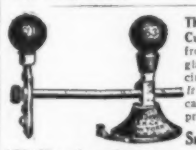

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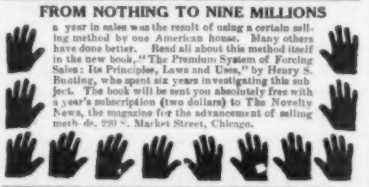

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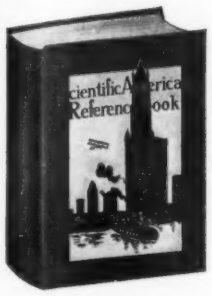

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